142-S-283
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INSTRUCTION MANUAL

MODEL 142-S-283
HF VCG GENERATOR

WAVETEK
SAN DIEGO

9045 BALBOA AVENUE, SAN DIEGO, CALIFORNIA

INSTRUCTION MANUAL

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HF VCG GENERATOR

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The Model 142-S-283 is identical to the standard Model 142, as described herein, except the VCG bandwidth is 300 kHz (3 dB) and usable to 1 MHz. The SYNC OUT has a 90.9Ω source impedance; SYN OUT signal is a 2 Vp-p square wave into a 93Ω load. Furthermore, three BNCs (VCG IN, SYNC OUT, and 50Ω OUT) are located on the rear panel; these BNCs are wired in parallel with their respective front panel BNCs. Do not load a front and rear panel BNC at the same time otherwise waveform amplitude and quality will be derated.

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The obligation of Wavetek hereunder shall expire one (1) year after delivery and is limited to repairing, or at its option, replacing without charge, any such product which in Wavetek's sole opinion proves to be defective within the scope of this Warranty. In the event Wavetek is not able to repair or replace defective products or components within a reasonable time after receipt thereof, Buyer shall be credited for their value at the original purchase price.

Wavetek must be notified in writing of the defect or nonconformity within the warranty period and the affected product returned to Wavetek's factory or to an authorized service center within thirty (30) days after discovery of such defect or nonconformity. Shipment shall not be made without prior authorization by Wavetek.

This is Wavetek's sole warranty with respect to the products delivered hereunder. No statement, representation, agreement or understanding, oral or written, made by an agent, distributor, representative or employee of Wavetek, which is not contained in this warranty, will be binding upon Wavetek, unless made in writing and executed by an authorized Wavetek employee. **Wavetek makes no other warranty of any kind whatsoever, expressed or implied, and all implied warranties of merchantability and fitness for a particular use which exceed the aforestated obligation are hereby disclaimed by Wavetek and excluded from this agreement. Under no circumstances shall Wavetek be liable to Buyer, in contract or in tort, for any special, indirect, incidental or consequential damages, expenses, losses or delays however caused.**

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SAFETY

This instrument is wired for earth grounding via the facility power wiring. Do not bypass earth grounding with two wire extension cords, plug adapters, etc.

BEFORE PLUGGING IN the instrument, comply with installation instructions.

MAINTENANCE may require power on with the instrument covers removed. This should be done only by qualified personnel aware of the electrical hazards.

WARNING notes call attention to possible injury or death hazards in subsequent operations.

CAUTION notes call attention to possible equipment damage in subsequent operations.

Figure i — Model 142 HF VCG Generator

SCOPE OF THIS MANUAL

This manual provides descriptive material and instructions for the installation, operation, maintenance, and repair of this instrument. Wavetek's product improvement program ensures that the latest electronic developments are incorporated in all Wavetek instruments by the addition of circuit and component changes as rapidly as development and testing permit. Due to the time required to document and print instruction manuals, it is not always possible to incorporate the more recent changes in the released manual. In this case, data will be found on engineering change sheets at the rear of the manual. If no change sheets are included, the manual is correct as printed.

SECTION 1
INTRODUCTION

1.1 PURPOSE OF THE EQUIPMENT

The Model 142 HF VCG Generator provides sine, square, triangle, positive pulse, and negative pulse outputs (with a separate sync output) over a 0.0005 Hz to 10 MHz frequency range. Frequency range selection is provided in ten decades; and a vernier control permits adjustment to within approximately 1% of the range selected.

The symmetry of any output waveform is continuously adjustable from 1:19 to 19:1 (5%-95% to 95%-5%). Pulse outputs as narrow as 50 nanoseconds having repetition rates as high as 1 MHz (on-off ratio as great as 19:1) can be generated in either polarity. Varying the symmetry of the triangle function will produce a sawtooth or "ramp" signal with a rise or fall time as steep as 50 nanoseconds at a recurring rate of 1 MHz. Even the symmetry of the sine wave may be varied over this 1:19 to 19:1 range if desired. When the symmetry control is used, however, the indicated frequency is divided by a factor of approximately 10.

A VCG input allows the output to be frequency modulated, dc programmed, or swept over a 1000:1 ratio. The dc offset of the 30V p-p maximum signal output can be controlled manually or electronically. A 60 dB calibrated step attenuator and a 20 dB vernier provide an overall attenuation of 80 dB; permitting signal levels as low as 1.5 mV p-p. Both the output waveform and the dc offset are attenuated by the 60 dB step attenuator.

With this instrument it is possible to simultaneously program and sweep the output frequency, select the output symmetry desired, and manually or electronically vary the dc offset. This capability, coupled with the variety of waveforms available and precision output amplitude control, makes the Model 142 an extremely versatile instrument for engineering, manufacturing, and laboratory applications.

1.2 GENERAL PHYSICAL DESCRIPTION

Weighing approximately 8 pounds (12 pounds when shipped) the Model 142 is 8-½ inches wide, 5-¼ inches high, and 11-½ inches deep. Housed in a compact, ruggedized, portable case; the Model 142 is normally shipped with one copy of this instruction manual.

1.3 SPECIFICATIONS

1.3.1 Versatility

WAVEFORMS

Selectable sine ∿ , square ⊓⊔ , triangle △ , positive pulse ⊓ , and negative pulse ⊔ outputs.

Symmetry of all outputs continuously adjustable from 1:19 to 19:1. Varying triangle symmetry provides a sawtooth ◺ or ◿ output. Separate sync with variable symmetry (see Sync Output specifications below).

OPERATING FREQUENCY RANGE

0.0005 Hz to 10 MHz in ten decades as tabulated below:

Ranges	
X.001	0.0005 Hz to .01 Hz
X.01	0.005 Hz to .1 Hz
X.1	0.05 Hz to 1 Hz
X1	0.1 Hz to 10 Hz
X10	0.1 Hz to 100 Hz
X100	1 Hz to 1 kHz
X1K	10 Hz to 10 kHz
X10K	100 Hz to 100 kHz
X100K	1 kHz to 1 MHz
X1M	10 kHz to 10 MHz

Note: When Symmetry control is used, indicated frequency is divided by a factor of approximately 10.

MAIN OUTPUT

Sine, square, triangle, positive pulse, and negative pulse; selectable. Maximum output 30 V p-p into open circuit (15 V p, pulse) with calibrated 15 V p-p into 50-ohm load. Precision output attenuator calibrated in 10 dB steps to −60 dB with a 20 dB vernier, giving an overall attenuation of −80 dB. Output impedance is 50-ohms. Short circuit current is ±150 milliamps.

SYNC OUTPUT

Amplitude greater than 4 V p-p into open circuit; 2 V p-p into 50 ohms. Square waveform for symmetrical outputs; rectangular waveform for pulse and ramp outputs. Sync pulse polarity is opposite that of output square wave.

DC OFFSET

Can be controlled manually using the front panel control, or electronically by applying an external voltage. Adjustable range is ±10 Vdc into open circuit (±5 Vdc into 50-ohm load) with peak output, at the output, limited to ±15 Vdc into open circuit (±7.5 Vdc into 50Ω). External offset sensitivity is approximately −0.4 V/V with output connected to 50-ohm load. DC offset and output waveform are attenuated proportionately by the 60 dB output attenuator.

1.3.2 Horizontal Precision

FREQUENCY ACCURACY (Dial Accuracy) Symmetrical Waveforms

0.01 Hz to 1 MHz ±(1% of setting + 1% of full scale).
1 MHz to 10 MHz ±(2% of setting +2% of full scale).

VERNIER

Permits frequency adjustment of approximately 1% of range.

TIME SYMMETRY

10 Hz to 100 kHz . . . . . ±0.5%
0.01 Hz to 500 kHz . . . . . ±1.0%

1.3.3 Voltage-Controlled Generator

VCG CONTROL RANGE

Up to 1000:1 frequency change with external voltage input. Upper frequency is limited to maximum of selected range. Required external signal for full voltage control is 5 volts with input impedance of 5 kΩ.

VCG INPUT FREQUENCY

VCG Bandwidth . . . . . 100 kHz
VCG Slew Rate . . . . . 2% of range/microsecond

VCG LINEARITY

10 Hz to 100 kHz . . . . . ±0.2% of full scale
0.001 Hz to 1 MHz . . . . . ±0.5% of full scale

1.3.4 Vertical Precision

SINE WAVE FREQUENCY RESPONSE

Amplitude change with frequency less than:

0.1 dB . . . . . to 100 kHz
0.2 dB . . . . . to 1 MHz
2.0 dB . . . . . to 10 MHz

STEP ATTENUATOR ACCURACY

±0.25 dB/10 dB

STABILITY

Short term . . . . . ±0.05% for 10 minutes
Long term . . . . . ±0.25% for 24 hours
Percentages apply to amplitude, frequency, and dc offset.

AMPLITUDE SYMMETRY

All waveforms (except pulse) are symmetrical about ground within ±1% of maximum peak-to-peak amplitude.

1.3.5 Purity

SINE WAVE DISTORTION

10 Hz to 100 kHz . . . less than 0.5% (typically 0.25%)
100 kHz to 1 MHz . . . . . less than 1.0%
1 MHz to 10 MHz . . all harmonics at least 30 dB down

TRIANGLE LINEARITY

0.002 Hz to 100 kHz . greater than 99% by using the best straight line method

SQUARE WAVE RISE AND FALL TIME (terminated in 50Ω load)

Less than 20 nanoseconds; limited to 500 V/microsecond.

TOTAL ABERRATIONS

Less than 5%

1.3.6 Environmental

TEMPERATURE

All specifications listed, except for stability, are for 25°C ±5°C. For operation from 0°C to 55°C, derate all specifications by a factor of 2.

1.3.7 Mechanical

DIMENSIONS

8-½ inches wide, 5-¼ inches high, 11-½ inches deep.

WEIGHT

8 pounds net, 12 pounds shipping.

POWER

105 V to 125 V or 200 V to 250 V; 50 to 400 Hz. Less than 35 watts.

1.4 ACCESSORIES AND ASSOCIATED EQUIPMENT

This instrument is normally shipped with a 10-foot, 3-wire, detachable line cord and a copy of this instruction manual. The items listed below are compatible accessories and associated equipment which may be helpful in the user's installation.

RACK ADAPTER KIT . . . . Wavetek No. 130-602

ADAPTER CABLE(S), SHIELDED. . . . . BNC Female to BNC Female
BNC Female to BNC Male
BNC Female to Dual Banana
BNC Female to Dual Alligator

NOTE
Specifications apply from 1-10 on the frequency dial.

SECTION 2
INSTALLATION AND OPERATION

2.1 MECHANICAL INSTALLATION

After unpacking the instrument, visually inspect all external parts for possible damage to knobs, connectors, surface areas, etc. If damage is discovered, file a claim with the carrier who transported the unit. The shipping container and packing material should be saved in case reshipment is required.

No mechanical installation is required when the instrument is to be used as a portable bench top instrument. If a rack-mounting configuration, or a Rack Adapter Kit (see paragraph 1.4), is provided, the unit may be mounted in a standard 19-inch equipment rack. Instructions for attaching the Rack Adapter Kit are provided with the kit.

2.2 ELECTRICAL INSTALLATION

2.2.1 Power Connection

Conversion for 230-volt operation requires resetting a switch at the rear of the instrument. To reset the 115/230 conversion switch (concealed by the rear panel) remove the rear panel, set the slide switch to 230, and replace the panel. Install a fuse with a rating of ¼ amp at 230 volts.

NOTE

Unless otherwise specified at the time of purchase, all Wavetek instruments are shipped from the factory with the power transformer connected for operation on a nominal 115-volt ac line supply, and a 3/8 amp 115V line fuse.

2.2.2 Signal Connections

Use 50Ω shielded cables equipped with female BNC connectors to distribute all RF signals when connecting this instrument to associated equipment.

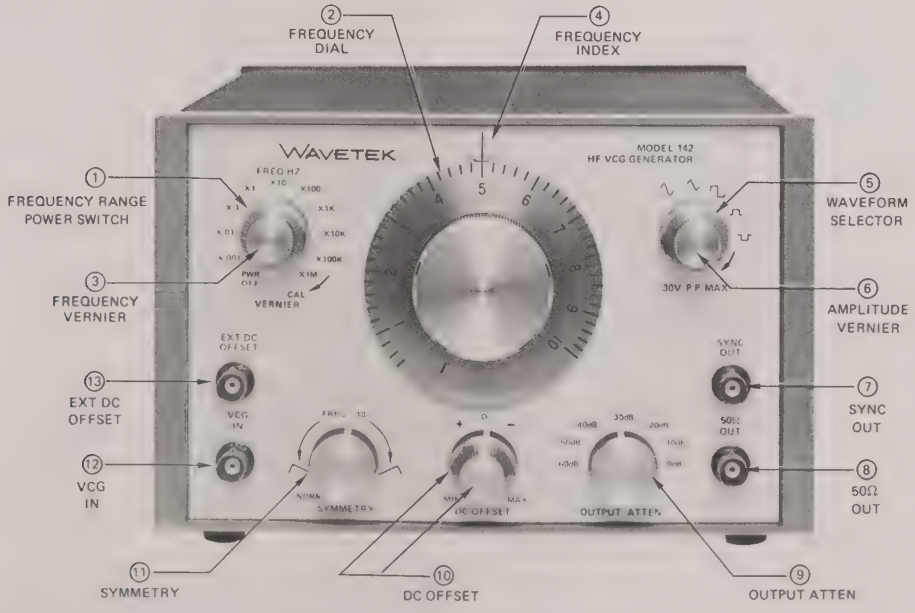


Figure 2-1 - Operating Controls

2.3 OPERATING CONTROLS

The operating controls and electrical connections for the Model 142 are shown in Figure 2-1. The listing below discusses each control and its function.

1. **Frequency Range/Power Switch** — This 11 position switch selects the generator frequency range. The extreme counter-clockwise position is the power off position.

2. **Frequency Dial** — This is the main frequency control. The setting on this dial multiplied by the frequency range setting (above) equals the output frequency of the generator. The frequency vernier (3) and the symmetry control (11) also affect the generator frequency. Note their effect in the listing below.

3. **Frequency Vernier** — This control allows precision control over the output frequency. A complete turn of this vernier is equivalent to approximately one half of the smallest division on the main frequency dial. When in the full clockwise position (CAL), the settings on the main dial will be accurate.

4. **Frequency Index** — The scribe line indicates the frequency dial setting. The index is illuminated when the unit is on.

5. **Waveform Selector** — This selects the waveform that appears at the 50Ω output connector. The waveforms are sine ∿ triangle △ square ⊓ positive going pulse and negative going pulse.

6. **Amplitude Vernier** — A vernier control of the output amplitude. Maximum clockwise position gives the full output amplitude of 30 V peak-to-peak into an open circuit or 15 V p-p into a 50Ω load, except positive and negative pulse which are 7.5 V zero-peak amplitude into 50Ω load. Counter-clockwise rotation will continuously reduce the output amplitude. The control gives a minimum of 20 dB variation (10:1). This control operates in conjunction with the output attenuator (9). For maximum amplitude output this vernier must be full clockwise and the output attenuator in the "0 dB" position.

7. **Sync Out** — This output provides a square or rectangular output at the same frequency of the main generator. The output amplitude is approximately 2 V p-p into 50Ω. The phase relationship between the sync output and the waveforms from the 50Ω output is as shown in Figure 2-3

8. **50Ω Out** — This connector provides the selected generator output function. The generator may operate into an open circuit providing 30 V peak-to-peak maximum, or into a 50Ω load providing a 15 V peak-to-peak output.

9. **Output Attenuator** — Attenuates the output from 0 dB (15 V p-p 50Ω max) to −60 dB (15 mV p-p into 50Ω) in six, 10 dB steps. The vernier (6) adds an additional −20 dB, thus, a maximum of −80 dB (1.5 mV p-p into 50Ω).

10. **DC Offset Control** — This coaxial switch controls the amount of dc or baseline offset above (+) or below (−) signal ground. The larger knob controls the polarity of dc offset and the smaller knob controls the amount of offset.

11. **Symmetry Control** — This controls the time symmetry between the positive and negative portions of the output waveform. In the full counter-clockwise (detent) position, the control is disabled and the output waveform has 1:1 symmetry (50% duty cycle). Rotating the dial clockwise will vary the symmetry from 1:19 through 19:1. Note: When the symmetry is off the NORM (detent) position the output frequency is divided by approximately a factor of 10. This allows a minimum pulse width of 50 nanoseconds.

12. **VCG (Voltage Controlled Generator) Input** — This connector allows external control of frequency. With 0 volts in, the generator output frequency is determined by the frequency range selected and the frequency dial setting. A positive VCG voltage will increase this frequency, and a negative voltage will decrease the frequency. Input impedance is 5 kΩ.

13. **External DC Offset** — This connector provides external control of dc level. This control only operates when the dc offset switch is in the 0 position. Maximum range is ±15 V dc and sensitivity is approximately −0.4 volts offset per volt input.

2.4 INSTALLATION CHECKS

This paragraph outlines a quick checkout procedure to determine if the instrument is operating properly. Field calibration and checkout instructions are given in Section 4 to determine compliance with electrical specifications. If electrical deficiencies exist, refer to the warranty on the back of the title page.

Use a Tektronix Model 454 oscilloscope (or equivalent) and a Monsanto Model 101A Counter-Timer (or equivalent) when performing these installation checks.

1. Before connecting the line cord to the ac line, set the front panel controls and switches as follows:

FREQ HZ (switch)	PWR OFF
FREQ DIAL (main dial)	10
VERNIER (control)	clockwise
WAVEFORM (switch)	∿
30 V P-P MAX (control)	clockwise
SYMMETRY (Switch/control)	NORM
DC OFFSET (switch)	0
DC OFFSET (control)	MIN
OUTPUT ATTEN (switch)	0 dB

2. Connect the oscilloscope to the 50Ω OUT connector with the cable, terminated in a 50-ohm load and connect the line cord to the ac line.

3. Set FREQ HZ to X100. A 1 kHz sine wave with an amplitude of less than 15 V p-p should be displayed on the oscilloscope.

4. Check each waveform (∿ , ⊓ , ⩘ , ⊓ and ⌐) using the WAVEFORM selector. Amplitude should read 15 V p-p. The amplitude for the pulse outputs should be 7.5 V peak. Return WAVEFORM selector to ∿ .

5. Observe the oscilloscope display and rotate FREQ DIAL clockwise to the 1 setting. The sine wave frequency should change from 1 kHz to 100 Hz. Check the range to range tracking accuracy with dial setting at 10.

6. With FREQ HZ set to X100K and FREQ DIAL set to .1, set VERNIER control fully counterclockwise. The output frequency should be 1 kHz or less.

7. Change the waveform selector to ⊓ and rotate SYMMETRY control slightly clockwise until symmetry function is activated. The output square wave should be unsymmetrical by a ratio of approximately 10. Continue rotating the SYMMETRY control through its entire range. The square wave symmetry should vary from 1:19 through 1:1 to 19:1 at the fully clockwise extreme.

8. Set 30 V P-P MAX fully counterclockwise and DC OFFSET switch to the "+" position. The baseline of the output waveform should remain at or very near zero. Rotate the DC OFFSET control from MIN to MAX; the baseline should shift to greater than 5 volts positive.

9. Set DC OFFSET switch to "–" and check that the dc offset of the output signal is variable over a range of zero to greater than 5 volts negative. Reset DC OFFSET switch to the "0" position.

10. Set 30 V P-P MAX control fully clockwise and rotate OUTPUT ATTEN switch through each position. Observe the oscilloscope display to check the output attenuation. See Section 2.5, paragraph 5.

2.5 OPERATING PROCEDURE

No preparation for operation is required beyond completion of the initial installation checks given in paragraph 2.4 of this manual. It is recommended that a one-half hour warm-up period be allowed for the associated equipment to reach a stabilized operating temperature, and for the Model 142 to attain stated accuracies.

2.5.1 Operation as a Function Generator

1. Properly terminate the 50Ω OUT connector.

2. Select desired output waveform using the WAVEFORM SELECTOR switch.

3. Set FREQ HZ switch to desired multiplier.

4. Set FREQ DIAL to desired setting by aligning with Index.

5. Set 30 V P-P MAX and OUTPUT ATTEN switch for desired output level and amplitude.

For reference, the following table gives the approximate output amplitude levels at attenuator settings. The output levels of the positive and negative pulse waveforms are one-half of these levels.

TABLE 2-1

Attenuator Position	Peak-to-Peak Output into 50Ω load.	
	Maximum (Vernier full CW)	Minimum
0 dB	15 volts	1.5 V
–10 dB	5 volts	500 mV
–20 dB	1.5 volts	150 mV
–30 dB	500 mV	50 mV
–40 dB	150 mV	15 mV
–50 dB	50 mV	5 mV
–60 dB	15 mV	1.5 mV

6. With DC OFFSET set to 0 and SYMMETRY control set to NORM, the output waveform should be a symmetrical waveform oscillating around a zero dc reference point. (Except when in a positive or negative pulse position.)

7. Select the polarity of dc offset desired using the DC OFFSET switch, and set the amount of offset using the MIN/MAX control. If an excessive amount of dc offset is used, waveform clipping may be observed. The sum of peak waveform voltage and the dc offset cannot exceed the maximum rated output of the generator. For example, on the 0 dB attenuator setting the maximum output is 15 V peak-to-peak or 7.5 V peak above and below zero volts. Offset plus peak voltage cannot exceed 7.5 V. See Figure 2-2.

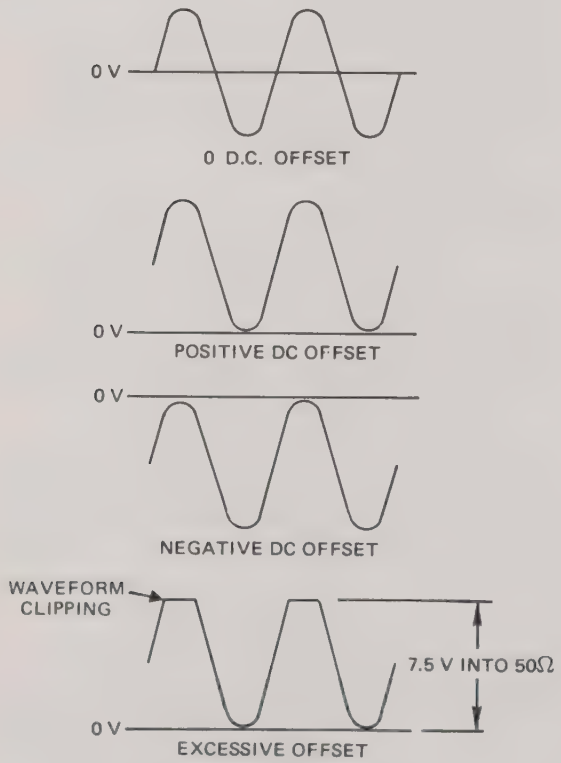


Figure 2-2 - DC Offset Control

8. Set SYMMETRY switch/control for desired symmetry or dissymmetry. The symmetry control can be used to develop ramp waveforms with variable rise fall ratios and pulse trains with variable duty cycle. By using the sine wave with dissymmetry, controllable sine distortion can be developed. Figure 2-3 shows the effect of this control on output waveforms.

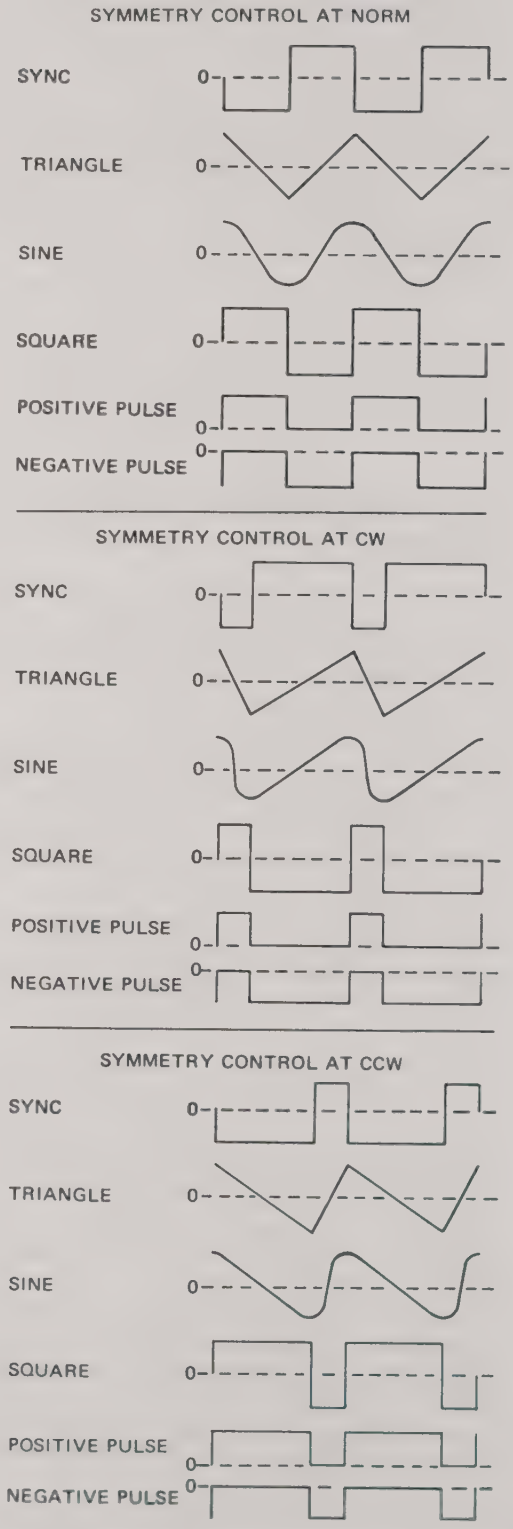


Figure 2-3 - Waveform Phasing and Symmetry Control

2.5.2 Operation as a Voltage Controlled Generator

The VCG input connector can be used to externally control the frequency of the generator. If a positive voltage is applied to the VCG input terminal the frequency will increase from the dial setting. A negative voltage will cause the frequency to decrease from the dial setting. The VCG range of the Model 142 is 1000:1. On any range multiplier setting, the frequency can be controlled from .01 x the multiplier to 10 x the multiplier. The nomograph of Figure 2-4 shows the characteristics of the VCG circuit. Column A gives the frequency dial setting, column B, the VCG voltage and column C, the resultant frequency of the generator.

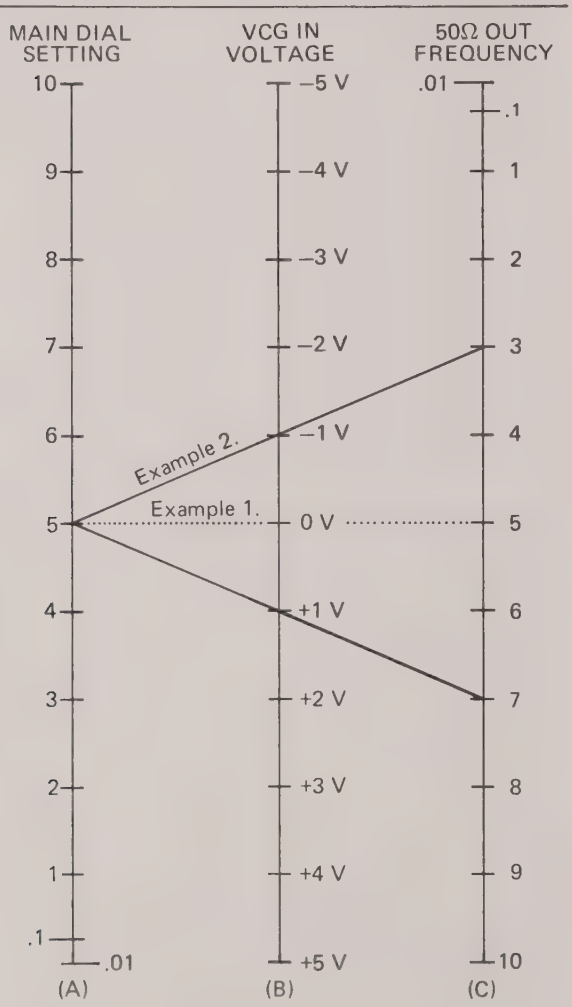


Figure 2-4 - VCG Voltage-to-Frequency Nomograph

In example 1, the dial is set at 5 and 0 volts VCG input voltage is applied. Extend a straight line from 5 (dial setting) through 0 volts (VCG voltage). The result is an output frequency of 5. (Multiplied by the range multiplier). In example 2, the dial is set at 5 and a varying VCG voltage of −1 V to +1 V is applied. By extending straight lines through the appropriate position it can be seen that the frequency will vary from 3 to 7 (x the range multiplier).

In order to set the generator at .01 x the range multiplier (1/1000 of the range) the following procedure is to be followed:

a) Using the frequency dial and a counter or oscilloscope, set the generator frequency to 0.1 x the range multiplier.

b) By rotating the vernier counter-clockwise, decrease the frequency to .01 x the range multiplier.

As can be seen from the nomograph a +5 volt VCG input will then cause the frequency to increase to the maximum of 10 x the range (and increase from .01 to 10 i.e. 1000:1).

2.5.3 Floating Output

This instrument is shipped from the factory with the signal ground floating above chassis ground, unless otherwise specified at the time of purchase. If a common signal/chassis ground is desired, perform the following modification:

1. Disconnect the power cord, loosen the two captive thumb screws on the rear panel, and remove the rear panel.

2. Slide the dust cover out from the rear, loosen the two screws on the rear plate and the two screws on the power supply board (at bottom of chassis) and remove the power supply board, flipping it over on the way out.

3. Solder one end of an insulated wire to the ground lugs (green wire) of the power connector and push the other end through the small opening on the main circuit board.

4. Solder the other end of the insulated wire to the ground terminal on the power supply board.

SECTION 3
CIRCUIT DESCRIPTION

3.1 SIMPLIFIED BLOCK DIAGRAM ANALYSIS

Refer to Figure 3-1, the Simplified Block Diagram, and Figure 3-2, the Simplified Timing Diagram, when reading this description. Paragraph 3.2 and its sub-paragraphs provide further descriptions of the functions of the basic circuits comprising this instrument. This paragraph describes, briefly, the major circuit elements and their relationship to one another.

As shown in Figure 3-1, the VCG Summing Amplifier sums the currents from the FREQ DIAL, VERNIER, and

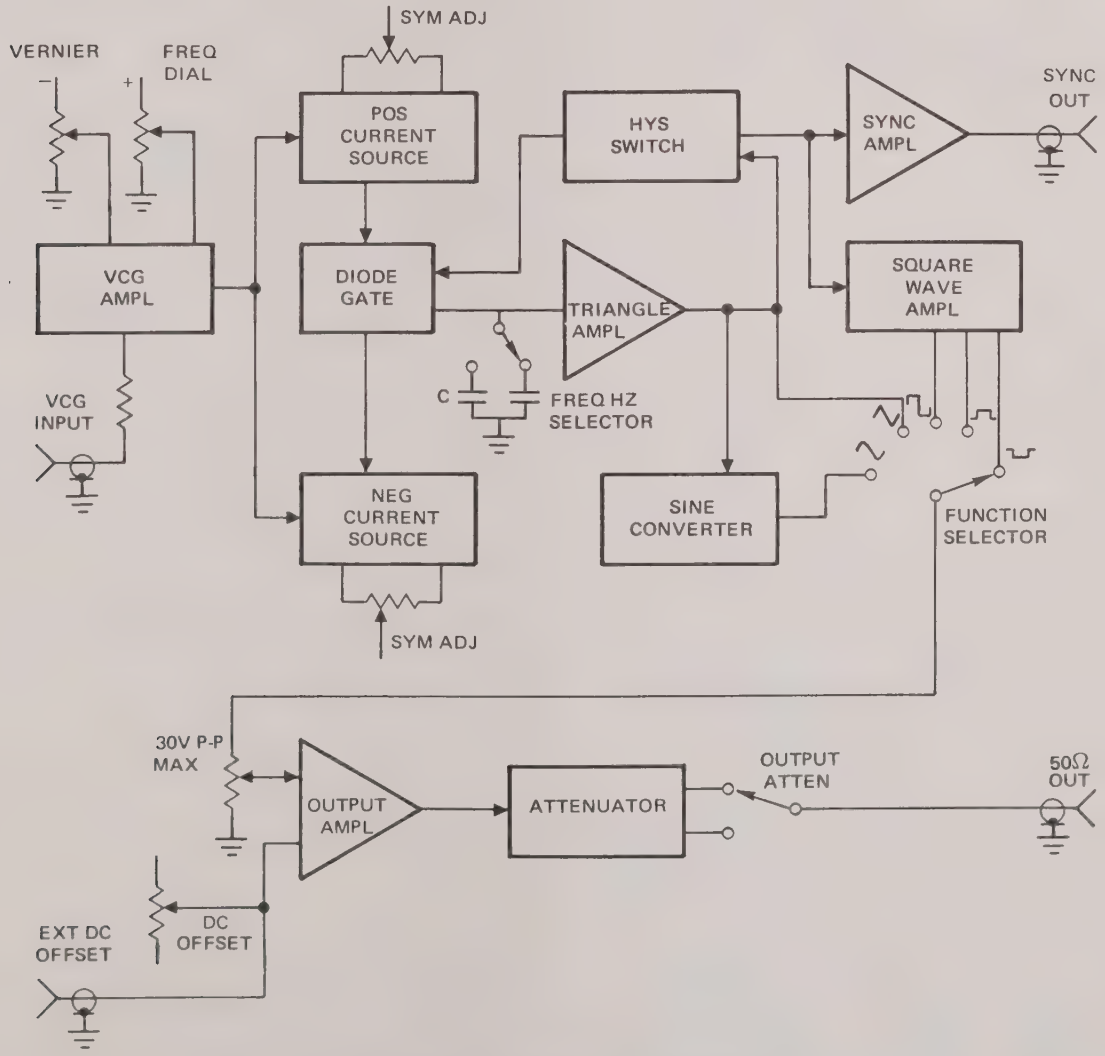


Figure 3-1 - Simplified Block Diagram

VCG IN connector. The VCG Summing Amp is an inverting amplifier whose output voltage is used to control a positive current source and a negative current source. For symmetrical output waveforms, the currents from the two current sources are equal and directly proportional to the voltage of the VCG Summing Amplifier output. The Diode Gate, which is controlled by the Hysteresis Switch, is used to switch the positive current or the negative current to the timing capacitor selected by the FREQ HZ

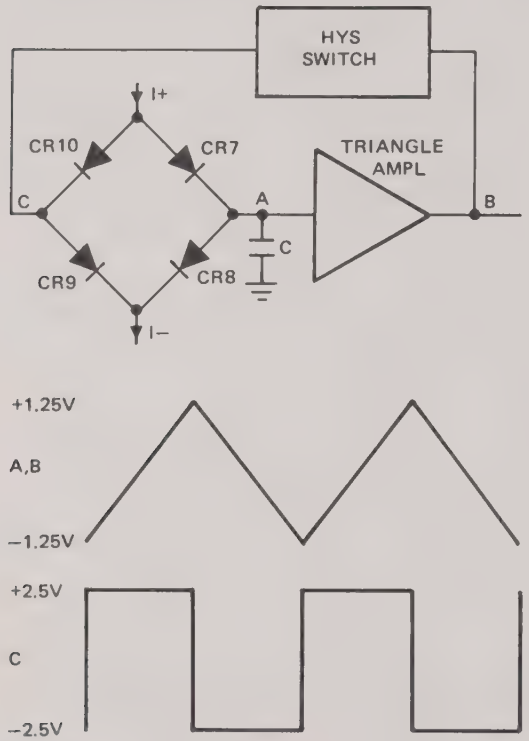


Figure 3-2 - Simplified Timing Diagram

selector. If the positive current is switched into the timing capacitor, the voltage across the capacitor will rise linearly to generate the triangle rise transition. If the current is negative, the voltage across the timing capacitor will fall linearly to produce the fall transition.

The Triangle Amplifier is a unity gain amplifier whose output is fed to the Hysteresis Switch as well as to the Sine Converter. The Hysteresis Switch has two voltage limit points (+1.25 V and −1.25V).

During the time the output voltage of the Triangle Amplifier is rising, the output voltage of the Hysteresis Switch is positive. But when the output voltage of the Triangle Amplifier reaches +1.25 V, it triggers the Hysteresis Switch causing the switch output to go negative. Once the control voltage into the Diode Gate becomes negative, it will switch the positive current out and switch the negative current in to the timing capacitor, so that the voltage across the capacitor will reverse, starting a linear decrease of the waveform. When the decreasing voltage reaches −1.25V, the output of the Hysteresis Switch will switch back to positive, reversing the process. This action generates the triangle waveform as shown in Figure 3-2. Since the output of the Hysteresis Switch is a square wave, the result is simultaneous generation of a square wave and a triangle wave at the same frequency.

The output frequency is determined by the magnitude of the capacitor selected by the FREQ HZ selector and the magnitude of the positive and negative current sources. Since the current sources are linearly proportional to the control voltage of the VCG circuit, the output frequency will also be linearly proportional to the control voltage.

If the current of the negative current source is decreased by 19 times, the fall time of the triangle will be 19 times longer than the rise time of the triangle; resulting in an unsymmetrical waveform and a division of the frequency by a factor of 10. Gradually increasing the current from the negative current source and decreasing the current from the positive current source in such a way that the period for the triangle to complete one cycle remains constant, the symmetry of the output waveform can be continuously varied while the frequency is held constant.

The inverted output of the Hysteresis Switch is fed to the Sync Amplifier and also the Square Wave Amplifier. The Square Wave Amplifier consists of a shaping circuit which limits the output swing to ±1.25 volts. For positive pulse outputs, it limits the output voltage swing from −1.25 V to 0 V; and for negative pulse outputs, it limits the output swing from 0 V to +1.25 V.

The output signal from the Triangle Amplifier is applied to the Sine Converter, consisting of a sine shaping circuit and a sine amplifier.

The sine, triangle, square, positive pulse, or negative pulse is fed to the Output Amplifier through the WAVEFORM SELECTOR switch and the 30 V P-P MAX control. The Output Amplifier is an inverting amplifier whose output is fed into a step attenuator and then to the output BNC connector.

The Attenuator consists of four pi attenuators, each having a 50-ohm input impedance and a 50-ohm output impedance. There is one −10 dB attenuator, one −20 dB attenuator, and two −30 dB attenuators. By combining them in different combinations, these four attenuators provide 10 dB steps of attenuation; from 0 dB to −60 dB.

3.2 FUNCTIONAL BLOCK DIAGRAM ANALYSIS

As each functional circuit is described, refer to the appropriate block diagram and, if necessary, the appropriate portions of the schematic diagrams at the rear of this manual.

3.2.1 VCG Amplifier and Current Sources

As shown in Figure 3-3, IC2 is connected as a Summing Amplifier to sum the VCG input current through R89, the current from the FREQ DIAL R82, and the current from the VERNIER control R90. IC2 is an inverting

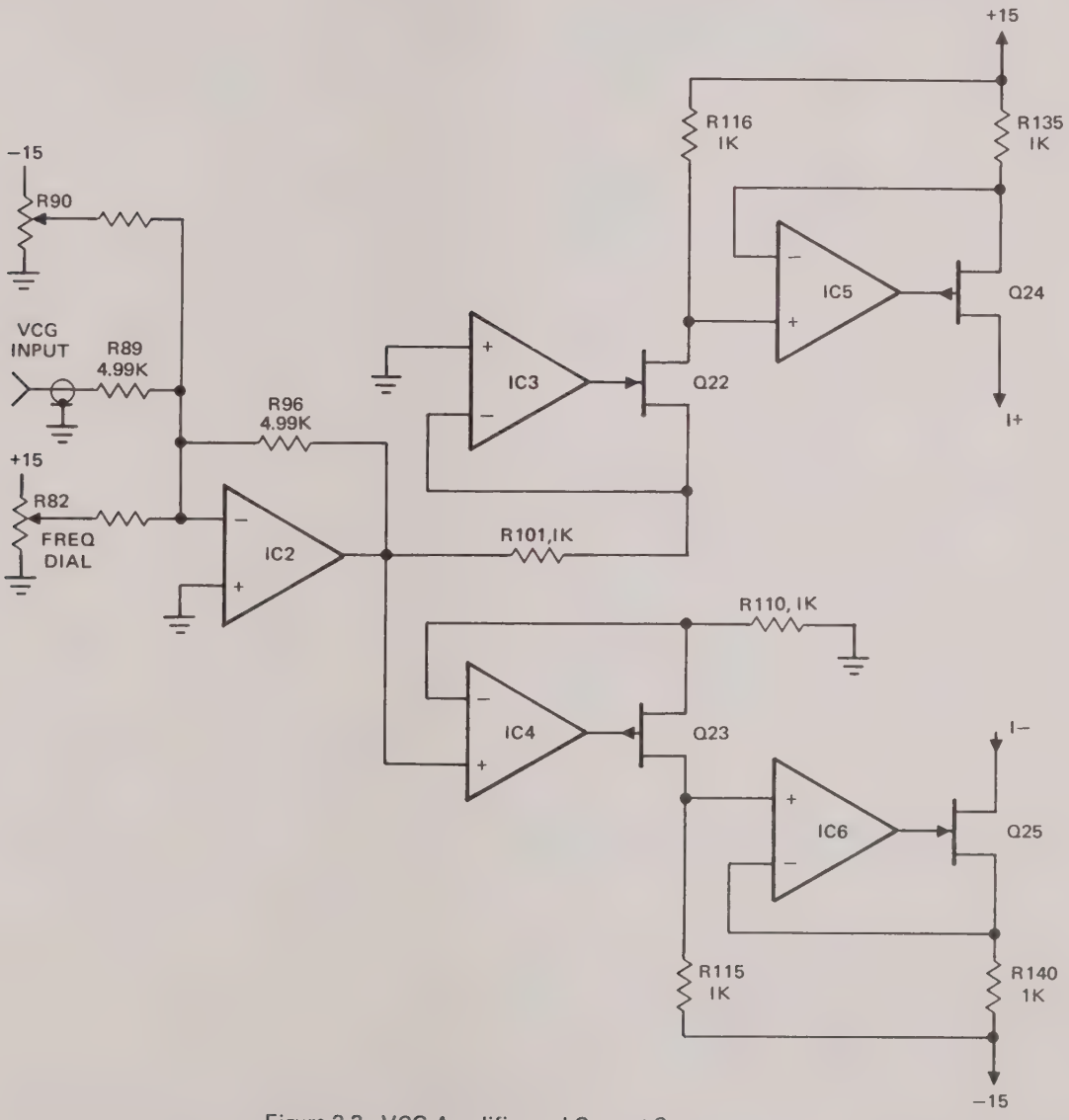


Figure 3-3 - VCG Amplifier and Current Sources

amplifier whose output voltage will change from 0 to −5 volts under normal operating conditions. Transistor Q21 limits the output swing to 0 and −7 volts. The output of IC2 is used to control both the positive and negative current sources, IC3 through IC6.

The negative input of IC3 is held at 0 volts by its feedback. The current through R101 would be directly proportional to the output voltage of IC2 if all the source currents of IC3 and IC5 are neglected, and the current through R116 would be equal to the current through

R101. Therefore, the voltage drop across R116 would be equal to the voltage drop across R101. Thus, amplifier IC3 is operated as a voltage level shifter to shift the voltage referenced from ground to a voltage referenced from +15 volts.

Due to the feedback control of amplifier IC5, the voltage drop across R135 would be equal to the voltage drop across R116 which in turn is equal to the voltage output of amplifier IC2. Since the positive current output from Q24 is directly proportional to the voltage across R135, it must also be proportional to the control voltage of the VCG amplifier.

Amplifiers IC4 and IC6 are very similar to amplifiers IC3 and IC5 except that IC3 is an inverting amplifier and IC4 is a non-inverting amplifier. If all the 1 kΩ resistors in Figure 3-3 are well matched, the positive output current (I+) and the negative output current (I−) will be equal and directly proportional to the control voltage. These two currents are alternately switched into a timing capacitor to generate a triangle waveform.

By increasing the resistance of R101 by 19 times, the voltage drop across R116 and R135 will be reduced to 1/19th of what it had been. Therefore, the output current (I+) will be 1/19th the negative current (I−). In this condition, a nonsymmetrical triangle with a rise to fall ratio of 19 to 1 and a frequency of 1/10th the original frequency (symmetrical frequency) is generated. If the resistance of R101 is decreased and the resistance of R110 is increased by exactly the same amount, the symmetry ratio will be gradually changed while the output frequency remains constant. Dual potentiometers R99 and R103 provide this SYMMETRY control.

For FREQ HZ multipliers of X10 to X1M, R135 and R140 are 1 kΩ resistors. Changing the FREQ HZ multiplier is accomplished by changing the timing capacitors connected to the diode gate.

For frequency ranges below X10, R135 and R140 are changed instead of changing the timing capacitors. In this case, the current from the current sources will go as low as 50 nA, and the source current of IC5 and IC6 can not be neglected. Therefore, a high impedance buffer amplifier Q26 and Q27 is inserted between Q24 and IC5, and another buffer amplifier Q28 and Q29 is inserted between Q25 and the negative input of IC6.

Q27 is connected as a constant current source supplying the bias current to Q26 and minimizing the change of V_{gs} of Q26 with temperature change. R129 provides dc offset adjustment of the buffer amplifier. Q28 and Q29 function exactly like Q26 and Q27.

Refer to the Main Board schematic diagram 142-210 at the rear of this manual. FREQ DIAL control R82 controls the amount of current supplied to the summing node of the VCG amplifier, thus controlling the output frequency. VERNIER control R90 provides fine frequency control. R93 is the zero adjustment for the negative input of IC2, so the VCG input terminal is not dependent on source impedance. R87 provides source current compensation for the negative input of IC2, permitting frequency adjustments at the minimum setting of the FREQ DIAL. The 100 kΩ potentiometers associated with IC3, IC4, IC5, and IC6 are used to zero offset the input terminal of the corresponding amplifiers.

3.2.2 Triangle Amplifier

The Triangle Amplifier consists of transistor Q1 through Q8, with Q1 and Q2 forming a very high input impedance differential pair. Q3 and Q4 supply constant bias currents to the differential pair, increasing the open loop gain of the amplifier. Q5 is connected as a 7-volt zener diode to shift the output level of Q6. The overall Triangle Amplifier is a unity gain amplifier with very low output impedance.

3.2.3 Hysteresis Switch

The Hysteresis Switch consists of a comparator and a flip-flop. The integrated circuit IC1 (CA3049) is the comparator, consisting of two differential amplifiers. One side of each differential amplifier, pin 7 and pin 10, are connected to ground through 22 ohm resistors. Potentiometers R23 and R12 establish the high and low voltage limits for the comparator. When the output of the Triangle Amplifier reaches +1.25 V, the transistor connected to pin 1 of IC1 will be conducting, and the collector current through pin 12 will be large enough to turn on the tunnel diode CR11, which in turn changes the state of the flip-flop. When the output of the Triangle Amplifier reaches −1.25 volts, the transistor connected to pin 7 of IC1 conducts and its collector current at pin 6 will be large enough to turn on tunnel diode CR13, reversing the state of the flip-flop.

There are three RC networks connected to pin 1 and three RC networks connected to pin 4 of IC1. These six RC networks provide frequency response compensation for IC1 and the entire loop of the Triangle Generator so that it will have a flat frequency response from dc to 10 MHz.

The flip-flop is comprised of transistors Q10 through Q16, with Q12 and Q13 connected as a differential pair. Q14 supplies a constant bias to the differential pair, preventing saturation during their "on" state. Q11 and Q16 are

voltage followers whose output is fed back to Q12 and Q13 through R46, R47, R54, and R55 forming the flip-flop configuration. Q9 is connected as a 7-volt zener reference for IC1 and the flip-flop.

In the state where Q13 is conducting and Q12 is cut off, the voltage at the emitter of Q16 is high (+2.5 V) and the voltage at the emitter of Q11 is low (−2.5 V). Once tunnel diode CR13 is turned on by IC1, the V_{be} of Q15 will increase until Q15 turns on and in turn Q13 is turned off. This causes the emitter voltage of Q16 to drop to −2.5 V which, through feedback resistors R47 and R46, keeps Q12 in tne on state. Thus the emitter voltage of Q11 will rise to +2.5 volts. Although the tunnel diode CR13 is turned on only a very short time during the peak of the triangle waveform, Q13 will remain in the off state because of the feedback through R46, R47, R54, and R55. The output of Q11 is used to drive the diode gate.

3.2.4 Diode Gate

As shown in Figure 3-4, the Diode Gate consists of four diodes, CR7 through CR10. Assume that the voltage at point C is +2.5 V. Diodes CR7 and CR9 are then forward biased, and CR8 and CR10 are reverse biased. The negative current source (I−) will draw current from the Hysteresis Switch through CR9, but the positive current source (I+) will charge up the timing capacitor "C" through CR7. The

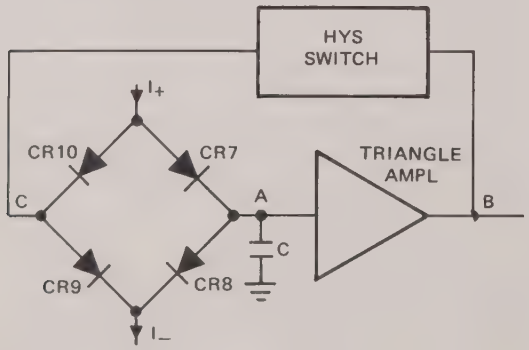


Figure 3-4 - Simplified Diode Gate Diagram

result is a linear rise of voltage across the timing capacitor. When this voltage reaches +1.25 volts, the output of the Hysteresis Switch will change to −2.5 volts. In this state, CR8 and CR10 are forward biased and CR7 and CR9 are reverse biased. The positive current will be diverted to the Hysteresis Switch through CR10 and the negative current source will draw current from the timing capacitor through CR8. This action causes a linear discharge of the timing capacitor. The process is repeated, thus a triangle waveform is generated.

3.2.5 Sine Converter and Amplifier

The Sine Converter is a sealed subassembly containing matched diodes and precise current-biasing resistive networks. When a precise triangle wave is fed into the shaping network, through voltage divider R149 and R148, the triangle wave is shaped into a sine wave. Potentiometers R159 and R168 adjust the voltage supplied to the sine converter to obtain minimum sine distortion. The amplitude of the sine converter output is approximately 150 mV p-p. This voltage is amplified to approximately 2.5 V p-p by the Sine Amplifier.

The Sine Amplifier consists of transistors Q30 through Q35 connected as a differential feedback amplifier. The gain of the amplifier is controlled by R165, R164, and R158. R145 and R146 compensate the source current into Q30 to minimize the distortion of the sine converter output.

3.2.6 Square Amplifier

The inverted output from Hysteresis Switch Q16 (±2.5 volt square wave) is fed to the Square Wave Shaper comprised of CR14 through CR19. For a square wave output, CR14 and CR19 are reverse biased. In one state, if the cathode voltage of CR15 is +2.5 volts, CR15 and CR17 will be reverse biased and CR16 and CR18 will be forward biased. The output at the cathode of CR18 is limited to +1.25 volts by the current through R63 and R64 into R69. When the input voltage is switched to −2.5 volts, CR15 and CR17 will be forward biased and CR16 and CR18 will be reverse biased, limiting the output at the cathode of CR18 to −1.25 volts by the current through R66 and R67 into R69.

When the positive pulse output is selected by the WAVEFORM SELECTOR switch, the cathode of CR14 is connected to ground through R61. In this configuration, the output at the anode of CR18 will be limited to a voltage swing of −1.25 and zero. Because the output amplifier is an inverting amplifier, the signal at the 50Ω OUT connector will be a positive pulse. In a similar manner, when the anode of CR19 is connected to ground through R61, the output swing at the cathode of CR18 will be limited to zero and +1.25 volts, resulting in a negative pulse at the 50Ω OUT connector.

C26 is a high frequency filter to filter the high frequency noise on the square wave, resulting in a cleaner signal. At this point, the output signal is buffered by a double emitter follower stage consisting of Q17 and Q18, and the output at the common emitters is applied to the output amplifier through the contacts of the WAVEFORM SELECTOR switch.

3.2.7 Sync Amplifier

The inverted output signal from Hysteresis Switch Q16 is also applied to another double emitter follower stage consisting of Q19 and Q20. The output at the common emitters of this stage is applied directly to the SYNC OUT connector at the front panel.

3.2.8 Output Amplifier

The Output Amplifier is comprised of a low frequency dc amplifier and a high frequency ac amplifier. The high frequency amplifier consists of Q50 thru Q55. IC8, an integrated circuit, is the low frequency dc amplifier. A simplified schematic of the Output Amplifier is shown in Figure 3-5. Refer to figure 3-5 during the following circuit description.

Assume that both the input and the output voltages are zero. The voltage at point A should also be zero. Because of the symmetrical configuration of the amplifier, the current through Q52 and Q53 will be equal, and the output will remain at zero.

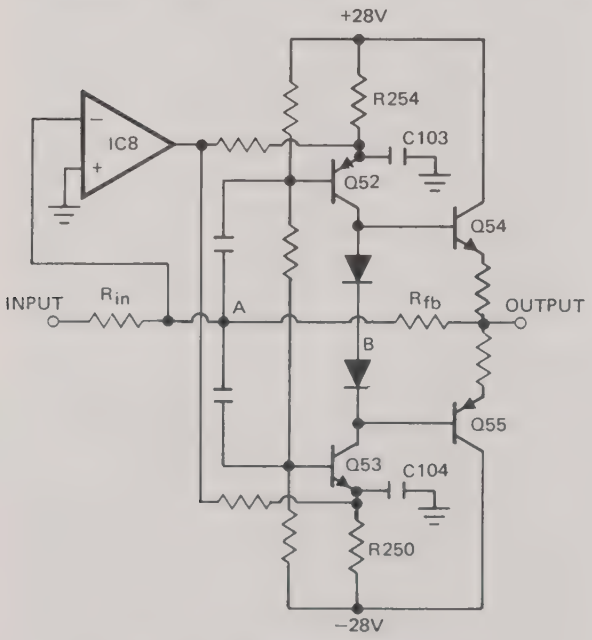


Figure 3-5 - Simplified Output Amplifier

If the input voltage goes positive, the voltage at point A will rise by a certain amount. This will cause the base voltage of Q52 to rise closer to +28 volts and at the same time cause the base voltage of Q53 to rise further away from −28 volts. Thus, the emitter-base junction of Q52 will be less forward biased therefore reducing its emitter current, while the emitter current of Q53 will increase because of the increased forward bias of its emitter-base junction. The result is that the voltage at point B and the output voltage will start to go negative. Finally, when the output has moved far enough negative to pull point A back to zero, the collector currents of Q52 and Q53 will again be equal and the voltage at point B will stabilize. The amount of negative voltage at the output required to pull point A back to zero is controlled by the ratio of R_{fb} and R_{in}, and this ratio is the gain of the output amplifier.

IC8 is a high gain low frequency amplifier used to bias the high frequency amplifier and to improve the overall open loop gain. Refering back to the main board schematic, the high frequency amplifier is dc isolated from the input by capacitance coupling to the bases of Q50 and Q51, then employs the low frequency amplifier IC8 to bias the emitters of Q52 and Q53 to obtain the required dc stability and high open loop gain. Emitter followers Q50 and Q51 increase the driving power to the bases of Q52 and Q53.

CR34 and CR35 compensate for the emitter-base junction voltage drops of Q54 and Q55 to reduce crossover distortion. The resistor-diode networks CR36, R263 and CR37, R264 serve to reduce the emitter resistance of Q54 and Q55 at high output current level, but maintain a full 10Ω emitter resistance at low output current level to protect Q54 and Q55 from damage due to thermal runaway.

R234, C88, and C89 form a high frequency compensation network which improves the corners of the square wave output at high frequencies. The two resistor-capacitor networks, R252, C103, and R253, C104, are emitter bypass circuits to maintain the high frequency amplifier gain during the transition time prior to the dc amplifier taking effect. This improves the rise time since the dc amplifier requires a few microseconds to respond and stabilize. Another compensation is C97 which bypasses R247 to give the signal a low impedance path during the signal transition allowing faster and more symmetrical rise and fall times.

Potentiometer R228 is used to calibrate the gain of the amplifier and C95 is used to calibrate the overshoot of the square wave output. The 30 V P-P MAX control R172 provides continuous adjustment of the output level over a range of 0 to −20 dB. This is in addition to the attenuation provided by the output step attenuator. Calibration potentiometer R188 is used to zero the offset of the output amplifier, and R167 is the front panel DC OFFSET potentiometer.

3.2.9 Output Attenuator

The Output Attenuator consists of four pi attenuators with some modification to minimize the number of components

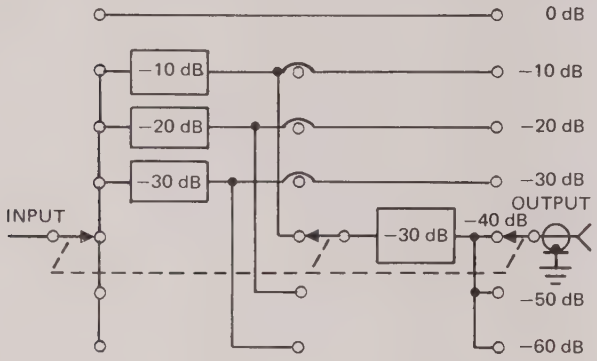


Figure 3-6 - Simplified Output Attenuator

used. The four attenuators employed are −10 dB, −20 dB, and two −30 dB attenuators; all with 50Ω input and output impedances. When the OUTPUT ATTENuator control is used to select −10 dB, −20 dB, or −30 dB; only one pi attenuator is used. When −40 dB, −50 dB, or −60 dB is selected; the second 30 dB pi attenuator is used in series with the appropriate attenuator to yield the desired total attenuation.

3.2.10 Power Supply

AC voltage is coupled from the transformer secondary to the bridge rectifiers CR1 through CR8. Filtering is provided by C1, C2, C10, and C12. Q9 is connected and operated as a zener reference for the +15 V supply. IC1 is a comparator differential amplifier whose output is used to drive transistor amplifier Q4, whose output at the collector is used to drive a Darlington connected pair consisting of Q1 and Q2. The Darlington connected pair provides added current gain; Q3 is a current limiting device. The base voltage of Q3 is biased by voltage divider R5 and R7 to be slightly below +15 volts. Therefore, for normal operation Q3 is reverse biased and no current flows through its collector. However, when the output current from the +15 volts exceeds a certain limit, the voltage drop across R12 will increase to a point exceeding the total voltage across R5 plus the base-emitter voltage of Q3, forward biasing Q3. The current driving the base of Q2 will be diverted to the collector of Q3, causing the power supply voltage to drop below normal operating voltage. As the power supply voltage drops, voltage divider R5 and R7 has more effect on the base of Q2; eventually turning it off completely. When the overload condition is removed, the normal condition will be restored.

The diode, CR9, across the input terminals of IC1 prevents latch-up. Potentiometer R21 is used to calibrate the +15 volt supply. The −15 volt, and ±28 volt supplies have similar circuitry. The −15 volt supply is referenced to the +15 volt supply while the +15 volt supply is referenced to the −15 volts. The −28 volt supply is referenced to the −15 volts, and the +28 volts is referenced to the +15 volt supply.

3.3 SUPPLEMENTAL CIRCUITS

There are no unique or supplemental circuits within the Model 142 HF VCG Generator to be separately described as "Supplemental Circuits". The preceding circuit descriptions adequately describe the circuitry of the Model 142 to the degree required by a competent technician.

SECTION 4
MAINTENANCE

4.1 ACCESS INSTRUCTIONS

Removal of the dust cover affords quick access to the majority of components within the unit. However, it may be necessary to remove the Power Supply Board or other parts to gain access to those components not exposed by removing the dust cover.

4.1.1 Removing the dust cover

To remove the dust cover (case) from the Model 142, the following procedure should be followed:

1. Unplug the power cord and unscrew the two captive screws on the rear panel.

2. Remove the rear casting and, with the instrument setting face down, lift the cover off slowly.

3. Reverse this procedure when replacing the dust cover. Tighten the two captive screws only finger-tight.

4.1.2 Removing the Power Supply Board

1. Remove two screws holding the Power Supply Board to the two side panels.

2. Loosen the two screws (from the outside of the rear plate) which hold the heat sink for the four power supply transistors.

3. Flip the Power Supply Board out of the chassis, toward the rear, and mount the board on the outside of the rear plate using the same two screws and the same two holes used to mount the heat sink.

N O T I C E

This instrument can be operated with the power supply board mounted on the outside of the rear plate. However, it should never be operated without having the heat sink of the power supply board connected to the rear plate of the unit, as the rear plate is also used as a portion of the heat sink for the power transistors.

N O T I C E

4.1.3 Switch Bracket Removal

1. Remove the four front panel knobs labeled OUTPUT ATTEN, DC OFFSET, SYMMETRY, and DC OFFSET MIN/MAX.

2. Unsolder the wire connected to the 50Ω OUT connector.

3. Loosen and remove the two screws which attach the switch bracket to the main circuit board, and slide bracket out toward the rear.

4. If necessary, unsolder the other wires connected to the switches.

4.1.4 Replacing Q54 and Q55

1. The base of the transistor heat sink is permanently secured with thermally conductive expoxy onto the front panel casting. To remove the transistor, unscrew the nuts holding the transistor to the base of the heat sink and unsolder the transistor leads on the main circuit board. Then remove transistor.

2. Before replacing the transistor, put some thermal compound or silicon grease along both sides of the bottom edge of the transistor for good thermal contact.

4.1.5 Front Panel Removal

1. Remove the rear panel and dust cover as described above, and unplug all the knobs.

2. Unsolder all BNC connectors, lable and unsolder FREQUENCY DIAL potentiometer leads, and unscrew the two nuts which hold the power transistors into the heat sinks.

3. Remove bulb from the indicator lamp, and remove four front panel retaining screws.

4. Pull the front panel straight forward to remove it.

4.2 CALIBRATION INSTRUCTIONS

This paragraph provides complete sequential calibration instructions for this instrument. The instructions are

concise and are written for the experienced electronics technician or field engineer having a working knowledge of this type of instrumentation.

WAVETEK maintains a factory repair department for those customers not possessing the necessary test equipment or personnel to maintain this type of instrument. If an instrument is returned to the factory for calibration or repair, a detailed description of the specific problem should be attached. This will hasten turnaround time.

4.2.1 Recommended Test Equipment

The following test equipment (or equivalent) is recommended for this calibration procedure. A quick checkout of the instrument can be made by comparing the indicated parameters with those given in the specifications portion of Section 1.

NOTE

The entire calibration procedure must be read first to determine initial control settings and test equipment connections required before attempting recalibration. The steps of this procedure should be performed in the sequence given, and the parts within each step should also be performed in the sequence given.

Table 4-1. TEST EQUIPMENT

Name	Required Characteristics	Recommended Manufacturer	Model
Oscilloscopes	To 250 MHz	Tektronix	454
or	To 30 MHz	Tektronix	544 with 1A1, 1A5
Oscilloscope		Tektronix	7904 with 7A13, 7A26, 7B70
Distortion Analyzer	To 600 kHz	Hewlett-Packard	334A
Spectrum Analyzer*	To 50 MHz	Hewlett-Packard	141S with 8552A, 8553L
Counter	To 10 MHz; 0.1% of reading accuracy		
DVM		Data Technology	30

*Required only to verify high-frequency sine distortion (no calibration).

4.2.2 Preliminary Procedures

1. Set the front panel controls to the positions listed below:

FREQ Hz	X 100
FREQ DIAL	10
WAVEFORM SELECTOR	Sine
30V P-P MAX	.3/4ths of full CW
DC OFFSET	0
SYMMETRY	NORM
OUTPUT ATTEN	−10 dB
VERNIER	full CW
MIN/MAX	full CCW

4.2.3 Power Supply Regulation

2. Following the instructions in paragraph 4.1.2, attach the Power Supply Board to the rear plate of the instrument.

3. Connect ac power to the instrument, and connect the voltmeter leads to TP1 (common) and TP2 (+15 V) on the Power Supply Board. See Figure 4-4.

4. Adjust R21 for a reading of +15 Vdc ±20 mV on the voltmeter.

5. Check the voltage at TP3 for −15 Vdc ±50 mV; at TP4 for +28 Vdc ±400 mV; and at TP5 for −28 Vdc ±400 mV.

6. Replace the board and the dust cover, and allow the generator to warm up for at least ½ hour before calibration.

4.2.4 VCG Amplifier – Zero Offset Adjustment

7. Connect a 5.1 kΩ resistor to each test lead of the voltmeter for isolation to prevent integrated circuit oscillations.

8. Set FREQ HZ to X 100, FREQ DIAL to full clockwise extreme, FREQ VERNIER to CAL and SYMMETRY to NORM.

Steps 9 through 12 deleted.

13. With FREQ DIAL still fully clockwise, set the voltage between IC2(2) and ground (at R95) to 0 Vdc ±1 mV, using R93.

14. Set FREQ DIAL to 1 and adjust voltage between TP6 and TP7 to 0 Vdc ±1 mV, using R129.

15. Adjust voltage between TP8 and TP9 to 0 Vdc ±1 mV, using R132.

4.2.5 Triangle Amplitude Adjustment

16. Set FREQ HZ to X 100, FREQ DIAL to 10, WAVEFORM SELECTOR to TRIANGLE, and SYMMETRY to NORM.

17. Connect the oscilloscope probe (a type W or 1A5 plug-in module should be used with the scope) to ∿ position of the WAVEFORM selector switch, SW2, see Figure 4-4.

18. Adjust the triangle amplitude to ±1.25 V ±5 mV, using R12 and R23, see Drawing 142-010.

4.2.6 Sine Distortion

19. Set FREQ HZ to X 100, VERNIER to CAL, WAVEFORM SELECTOR to SINE, FREQ DIAL to 10, and OUTPUT ATTEN to 0 dB.

20. Set 30 V P-P MAX control to 3/4ths of full CW, and connect oscilloscope probe to ∿ position of the WAVEFORM selector switch (SW2), see Figure 4-4.

21. Adjust R153 so that the dc offset of the sine amplifier is zero.

22. Connect the test equipment as shown in Figure 4-1, and adjust R159, R168, and R145 for minimum sine wave distortion.

23. Set FREQ HZ to X 1K and readjust R159, R168, and R145 for optimum sine distortion.

24. Set FREQ HZ to X 100 and readjust R159, R168, and R145 if necessary

25. Alternately perform steps 24 and 25 until the least amount of sine wave distortion is obtained on both ranges — typically .14%.

26. Adjust R165 for a 2.5 V p-p signal output from the sine amplifier ±25 mV.

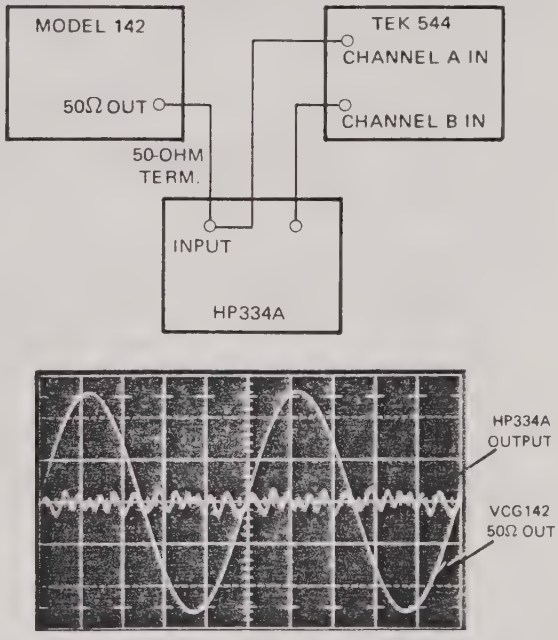


Figure 4-1 - Distortion Analysis Test Set-Up

27. Readjust R153 so that the dc offset of the sine amplifier is 0 V ±5 mV.

28. Connect the Spectrum Analyzer as shown in Figure 4-2, and check the sine wave distortion at frequencies higher than 600 kHz. If distortion does not meet the specification, check calibration of C95, follow procedure 4.2.10.

4.2.7 Frequency Calibration

29. Set FREQ HZ to X10K, FREQ DIAL to 10, VERNIER to CAL, and adjust R269 to obtain 100 kHz ±100 Hz.

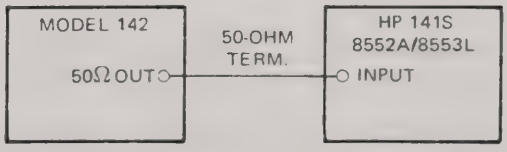


Figure 4-2 - Spectrum Analysis Test Set-Up

30. With FREQ HZ still at X10K, FREQ DIAL fully clockwise, VERNIER fully counterclockwise, and adjust R87 to obtain an output of 75 Hz ±5 Hz.

31. Rotate VERNIER to CAL position. The output frequency should be less than 1 kHz.

32. Set FREQ HZ to X1M, FREQ DIAL to 9, and adjust C1 to obtain an output frequency of 9 MHz ±10 kHz. Check frequency accuracy from 1 to 10 of the DIAL and readjust C1 to split the error if necessary. (Trim C2 if necessary.)

33. Set FREQ HZ to X100K, FREQ DIAL to 10, VERNIER to CAL, and adjust C10 to obtain 1 MHz ±1 kHz at the output. Check frequency accuracy from 1 to 10 of the DIAL and readjust C10 to split the error if necessary. (Trim C12 if necessary.)

34. Set FREQ DIAL to 10, VERNIER to CAL.

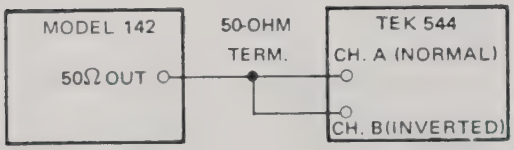
35. Set FREQ HZ to X1K, adjust R268 to obtain 10 kHz ±10 Hz.

36. Set FREQ HZ to X100, adjust R267 to obtain 1000 Hz ±1 Hz.

37. Set FREQ HZ to X10, adjust R84 to obtain 100 Hz ±0.1 Hz.

4.2.8 Time Symmetry Adjustment

38. Refer to the following test set-ups during these calibration instructions.



Trigger: Internal

Display: Alternate

Time Base: .1 ms/division for 1/1000th of X100K range.

Figure 4-3 · Time Symmetry Measurement Test Set-Up

39. With 50Ω OUTPUT connected to the oscilloscope; set FREQ HZ to X 100K, FREQ DIAL to full clockwise extreme, and WAVEFORM SELECTOR to **SQUARE WAVE with VERNIER full ccw (100 Hz).**

40. Adjust the scope controls for a display speed of .1 ms/cm and adjust VERNIER control until the oscilloscope screen is filled by one complete cycle.

41. **Adjust R107 for optimum time symmetry, while keeping the total time period constant.**

4.2.9 Output Amplifier Adjustment

42. With the Model 142's 50Ω OUT connected to the oscilloscope using a 50Ω ±1% termination; set FREQ HZ to X 100, FREQ DIAL to 10, WAVEFORM SELECTOR to TRIANGLE and step attenuator to 0 db.

43. Set 30V P-P MAX control fully counterclockwise, and adjust R188 for amplitude symmetry about ground.

44. Set 30V P-P control fully clockwise, and adjust R228 for a 15 V p-p output amplitude.

45. Set WAVEFORM SELECTOR to SQUARE WAVE, and adjust R66 for +7.5V and R63 for −7.5V peak amplitude. (15.0 V p-p.)

4.2.10 High Frequency Response Adjustment

46. Set FREQ HZ to X 1M, FREQ DIAL to 1, and WAVEFORM SELECTOR to SQUARE WAVE.

47. Adjust C95 for best square wave, without peaking, from 5 V p-p to 10 V p-p output amplitude.

48. Set WAVEFORM SELECTOR to SINE WAVE. FREQ DIAL to 10.

49. Adjust C48 to obtain 14 V p-p output amplitude.

4.3 CORRECTIVE MAINTENANCE

If the instrument appears to be operating abnormally, and an investigation of input/output connections, as well as a calibration check, do not cure the problem; follow the trouble-shooting procedure outlined below. Localize the fault to a specific stage by following the outline in Table 4-2. Then check the dc operating voltages at the pins of the solid-state devices, and check passive components with a high input impedance ohmmeter (power off) before replacing a suspected semiconductor element.

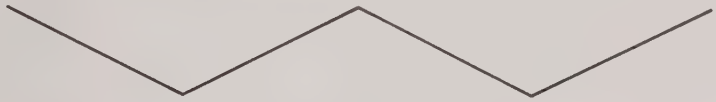
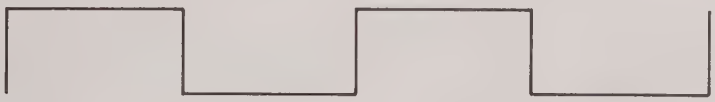
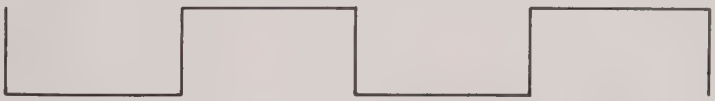
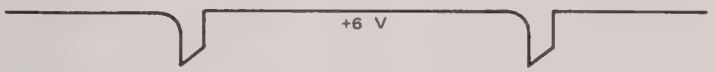
Table 4-2. TROUBLE-SHOOTING GUIDE (continued)

Symptom	Corrective Action
Blown Line Fuse	Replace F1 with a slow blow fuse of the proper amperage. If fuse blows again, check the following: a) Q54 or Q55 may be shorted between the collector and emitter. b) Q1, Q8, Q10, or Q16 may be shorted to the heat sink bracket. c) A capacitor or transistor may be shorted. d) Check for loose wires or solder bridges on each printed circuit board.
Power Supply Malfunctions	If there is a symptom of power supply malfunction, disconnect all wires between the power supply board and the main board and check the following: a) All power supply output voltages. If all are either too high or too low, the trouble is probably in the +15 V supply as all supplies are directly or indirectly referenced to it. b) Check CR9 through CR12. A defective or incorrectly polarized diode will cause the integrated circuits to latch up. c) Reference voltage at collector of Q9 should be +6.6 V ±0.3 V with +15 V in normal condition.
No output Signal but SYNC output normal	The output amplifier is malfunctioning; see Output Amplifier Check outlined below.
No SYNC Output. but Output normal	The Sync Amplifier is malfunctioning; see Sync Amplifier Check outlined below. Also check Q19 and Q20 for proper operation.
No SINE Output TRIANGLE and SQUARE are OK	Sine Amplifier is malfunctioning; See Sine Amplifier Check outlined below.
Badly Distorted SINE Output TRIANGLE is OK	Sine Module is malfunctioning and should be replaced. First check Q34 or Q35 for possible trouble.
No SYNC and 50Ω OUTput	The Triangle Generator is not functioning properly. Check Triangle Amplifier, Hysteresis Switch, Diode Gate, and VCG circuits.
SQUARE WAVE Output has Abnormally Slow Rise or Fall Times	Check all bypass capacitors (C103, C104, C93, C94 and C97) in the Output Amplifier. Check Output Amplifier as outlined below.
TRIANGLE Output has Constant Positive Slope with change of Frequency	Check Q23 and Q25 for possible trouble; then check IC4 and IC6 and their associated circuitry.
TRIANGLE Output has Constant Negative slope with Change of Frequency	Check Q22 and Q24 for possible trouble; then check IC3 and IC5 and their associated circuitry.
Checks VCG Amplifier & IC3-IC6	With SYMMETRY control set to NORM, slowly turn FREQ DIAL from 0.1 to 10 and observe the following:

Table 4-2. TROUBLE-SHOOTING GUIDE (continued)

Symptom	Corrective Action
VCG Amplifier & IC3-IC6 (Continued)	a) Voltage at emitter of Q21 should move from 0 to −5 volts. b) Source of Q22 remains at 0 and drain moves from +15 V to +10 V. c) Source of Q23 moves from 0 to −5 V and drain moves from −15 V to −10 V. d) Source of Q24 moves from +15 V to +10 V. e) Source of Q25 moves from −15 V to −10 V. f) Voltage at drain of Q27 follows voltage at gate of Q26. g) Voltage at drain of Q29 follows voltage at gate of Q28.
Triangle Amplifier Check	Short the gate of Q1 to ground and check the following: a) Gate of Q2 is at 0 volts. b) Voltage across C14 is approximately 6.6 volts. c) If "a" or "b" is not true, check all transistors in Triangle Amplifier for possible trouble.
Hysteresis Switch Check.	a) Voltage at collector of Q9 is approximately 6.6 volts. b) Voltage at collector of Q14 is approximately 7 volts. c) Voltage at junction of R49 and R50 is approximately −3 volts. d) For normal operation, voltage at the emitters of Q11 and Q16 switches between +2.5 volts and −2.5 volts. If switch does not oscillate, proceed as follows: e) If voltage at gate of Q2 is greater than +1.25 V, the voltage at the emitter of Q16 should be +2.5 V and the emitter of Q11 should be −2.5 V. If the voltage at the gate of Q2 is less than −1.25 V, the voltage at the emitter of Q16 should be −2.5 V and the emitter of Q11 should be +2.5 V or the Hysteresis Switch is malfunctioning. f) Q10 should be saturated if voltage at pin 1 of IC1 is above ground, and Q15 should be saturated if voltage at pin 4 of IC1 is below ground. g) If Hysteresis Switch appears to function normally, and Triangle Amplifier also appears to function normally, but no oscillations are present at the output; check CR7 through CR10, Q24 and Q25.
Sine Amplifier Check	If the voltage at the bases of Q30 and Q31 are not equal, check Q30 through Q35 for possible trouble.
Output Amplifier Check	Check the collector and emitter voltages of all transistors in the Output Amplifier circuit. Some key voltage test points are listed below: a) Voltage at junction of C94 and C93 is zero volt. b) Voltage at base of Q52 is approximately +19 volts. c) Voltage at base of Q53 is approximately −19 volts. d) Voltage at pin 12 of IC8 is between −5 volts to +10 volts.

Table 4-3. KEY WAVEFORMS

Test Point	Waveform
SYNC Output, ±2.5 V	
Triangle Ampl Out, ±1.25 V (at WAVEFORM SELECTOR)	
Sine Ampl Out, ±1.25 V (at WAVEFORM SELECTOR)	
Square Ampl Out, ±1.25 V (at WAVEFORM SELECTOR)	
50Ω OUT (Inverse of 3 above)	
Q11 Emitter, ±2.5 V	
Q10 Base	
Q15 Base	
Sine Module pin 2 (±600 mV)	
Sine Module pin 5 (±125 mV)	
CR10 Anode, ±2 V	
CR9, Cathode, ±2 V	

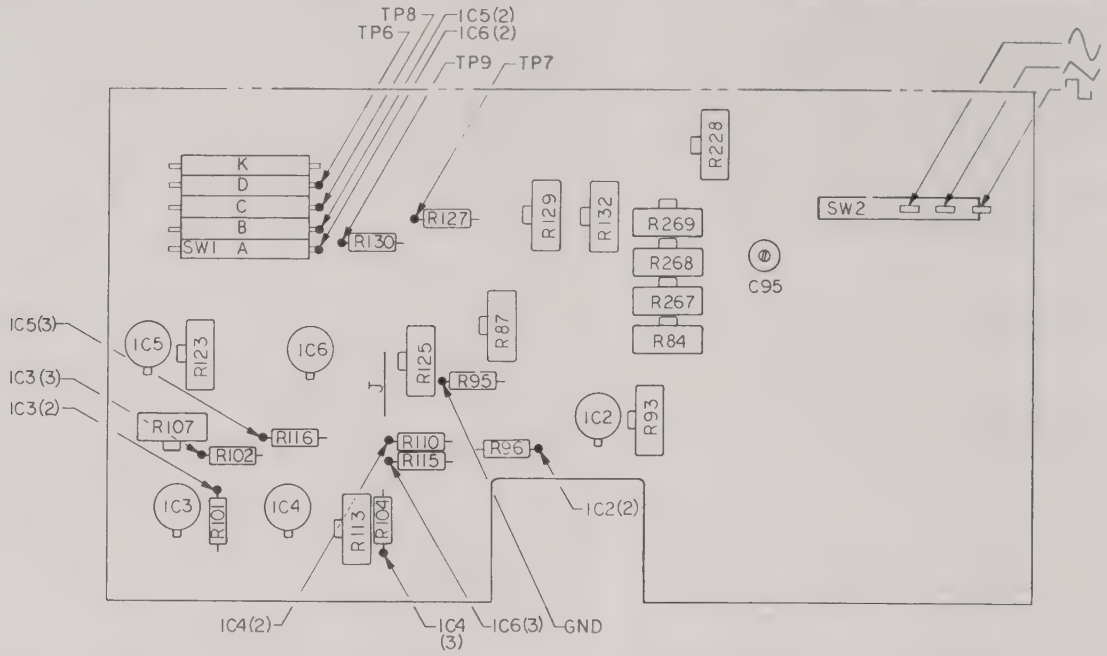


Figure 4-4 - Main Board Test & Calibration Points

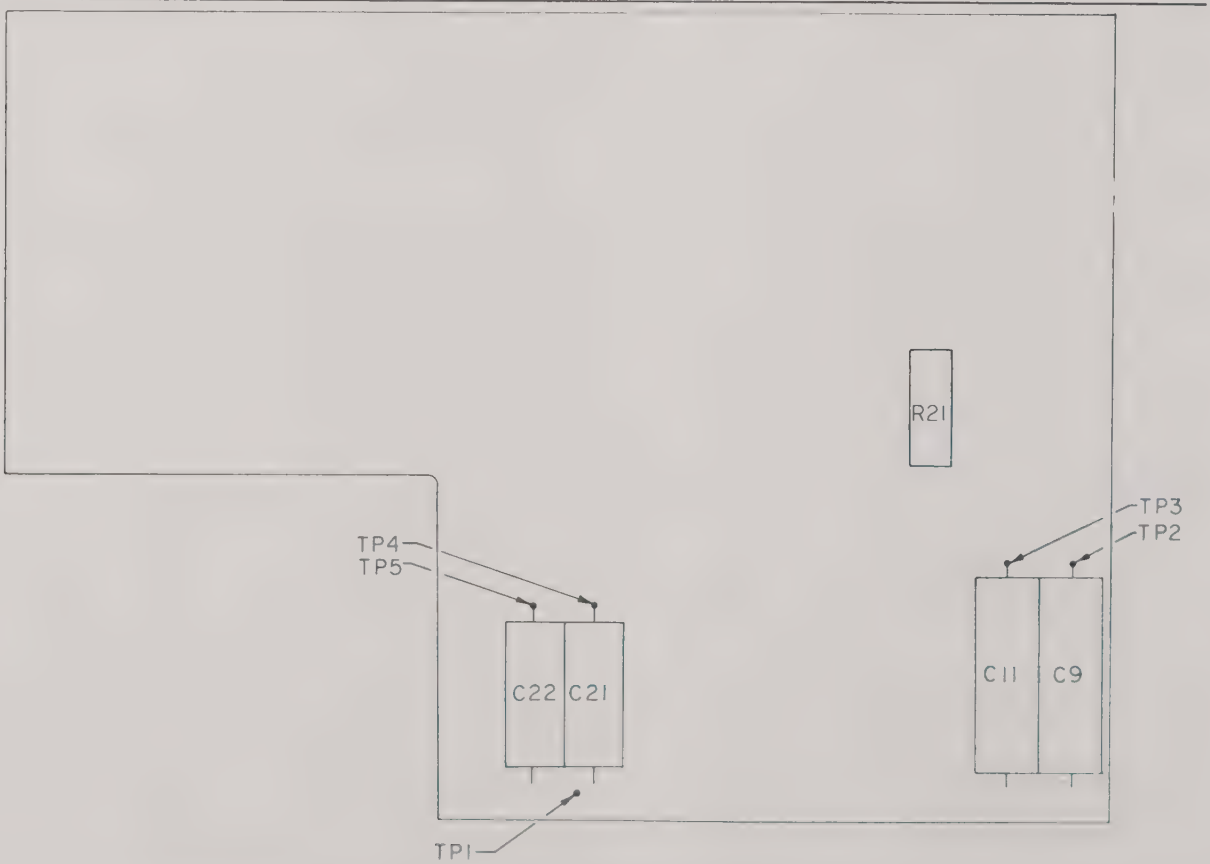


Figure 4-5 - Power Supply Test & Calibration Points

SECTION 5
DIAGRAMS ADDENDUMS AND PARTS LIST

5.1 DIAGRAMS

The schematic diagrams within this manual are, wherever possible, arranged in the sequence followed in the circuit description. Whenever assembly drawings are included, they are positioned adjacent to the schematics for maximum information presentation and minimum page flipping. Additional voltage or waveform information, beyond that given in the circuit description, may be shown on the schematic diagrams, at test points and key locations throughout the instrument.

5.2 ADDENDUMS

Under WAVETEK's product improvement program, the latest electronic designs and circuits are incorporated into each WAVETEK instrument as quickly as development and testing permit. Because of the time needed to compose and print instruction manuals, it is not always possible to include the most recent changes in the initial printing. Whenever this occurs, addendum pages are prepared to summarize the changes made under a WAVETEK Engineering Change Notice (ECN) and these ECN pages are inserted immediately inside the rear cover. If no such pages exist, the manual should be correct as printed.

5.3 PARTS LISTS

Whenever possible, an assembly drawing and the associated parts list are kept to one piece of paper or are positioned for maximum information presentation. The following list of manufacturers should be used in conjunction with the parts lists. The abbreviations shown below are used in the "Manufacturer Key" column on the parts lists.

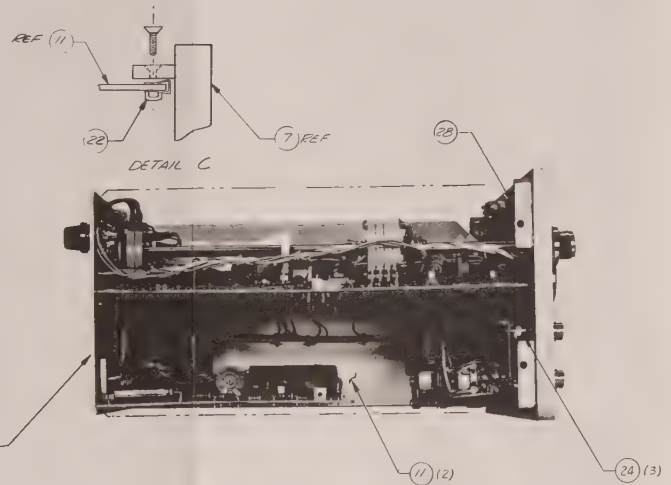
CROSS REFERENCE FOR DRAWING NUMBERS

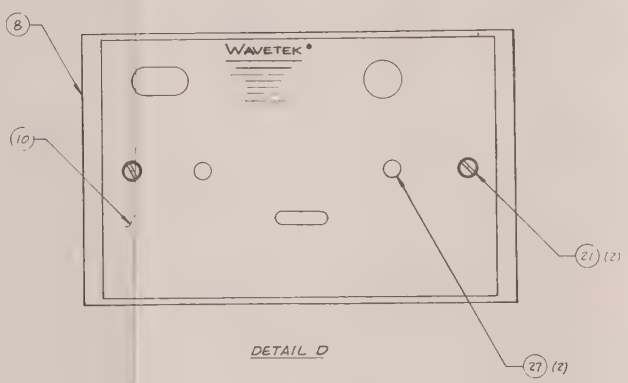
Drawings	Old Number	New Number	Drawings	Old Number	New Number
Chassis Assy	142-000	0102-00-0292	Attenuator Switch Assy	142-003	0102-00-0008
Chassis Schematic	142-200	0004-00-0033	Attenuator Switch Schem	142-203	0104-00-0008
Chassis Parts List	*	1101-00-0033	Attenuator Switch P/L	*	1202-00-0008
Main Board Assy	142-010	0101-00-0052	Rear Plate Assy	142-001	0102-00-0326
Main Board Schematic	142-210	0103-00-0052	Rear Plate Parts List	*	1101-00-0067
Main Board Parts List	*	1100-00-0052			
Power Supply Assy	144-011	0101-00-0054	Bracket Assy	142-002	0102-00-0327
Power Supply Schematic	144-211	0103-00-0054	Bracket Parts List	*	1101-00-0068
Power Supply Parts List	*	1100-00-0054			

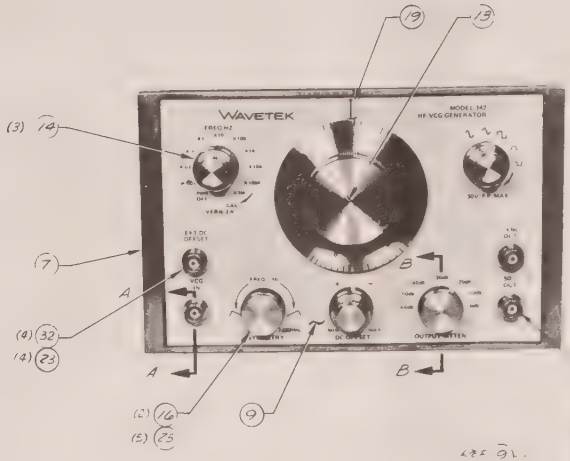
*Same as assembly number

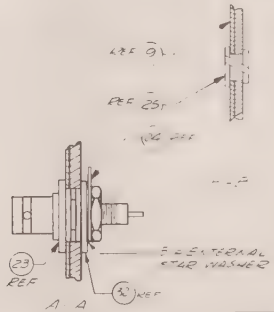
LIST OF MANUFACTURERS

A B	Allen Bradley
A-E	Arco-Elmenco
AER	Aerovox
ALC	Alco Electronic Products Inc.
AMP	Amp Inc.
APL	Amphenol
APX	Amperex
A R	American Radionics, Inc.
BEL	Belden
BMC	Budwig Mfg. Co.
BOU	Bourns
B T	Boots-Townsend Aircraft
BUR	Burroughs
BUS	Bussman
CAM	Cambion
C-D	Cornell Dubilier
CGW	Corning Glass Works
C-J	Cinch Jones
C-K	C and K Components
C-L	Centralab
CTS	Chicago Telephone Systems
C-W	Continental Wire
DEU	Deutsch
DIO	Diodes Inc.
E-C	Electro Cube, Inc.
E-E	Elma Engineering
EFJ	E.F. Johnson Co.
ELC	Elco Corp.
ELP	Elpac Inc.
ETP	Erie Technological Products, Inc.
FCD	Fairchild
G-E	General Electric
G H	Grayhill
G-R	General Radio Co.
HHS	Herman H. Smith, Inc.
H-P	Hewlett-Packard
IBM	IBM Industrial Products
IMB	IMB Electronics Products
IRC	International Resistance Company
JEF	Jeffers
KEI	Kings Electronics Inc.
LIT	Littelfuse
MAL	Mallory
M-C	Mura Corp.
MEK	Mektron
M-O	Marko-Oak
MOC	Micro-Ohm Corp.
MOL	Molex
MOT	Motorola
M-R	Milton Ross Co.
PPP	Phipps Precision Products
Q-C	Quality Components
QHM	Quality Hardware Mfg.
RCA	Radio Corporation of America
R-E	Richey Electronics
RMC	Radio Material Co.
ROS	Rosan Inc.
R-T	Rubber Teck Inc.
SCC	Stackpole Carbon Co.
SEL	Selectro
SEM	Semtech
S-I	Switchcraft Inc.
SLC	Shur-Lok Corp.
SPR	Sprague
S-T	Sarkes Tarzian
STR	Stettner & Co.
SUP	Superior Electric Co.
SYL	Sylvania
TAS	Teledyne Amelco Semiconductor Co.
T-I	Texas Instruments, Inc.
TRW	TRW Capacitor Division
USE	USECO Inc.
W-E	Wells Electronics
WEI	Wakefield Engineering Inc.









H	E.C.N. 2484			
G	ECN 1725	R.O.	5-4-78	
F	E.C.N. 1644	K.S.	4-25-77	
E	ECN 1482	R.O.	10/1/76	
D	REV. TO B2	T.M.	7-1-75	
C	ECN 664	R.O.	1-1-75	
B	386	R.O.	9-9-74	
A	321	R.O.	10-24-73	

tolerance unless otherwise specified	rev	eco	by	date	app
XXX ± .010 XX ± .030					

WAVETEK san diego, calif.

scale N/A	by [illegible]	date 5/	app'd [illegible]
material N/A	title CHASSIS ASSY		
finish N/A	mode no. 142	dwg no. 010C-00 C392	rev 4

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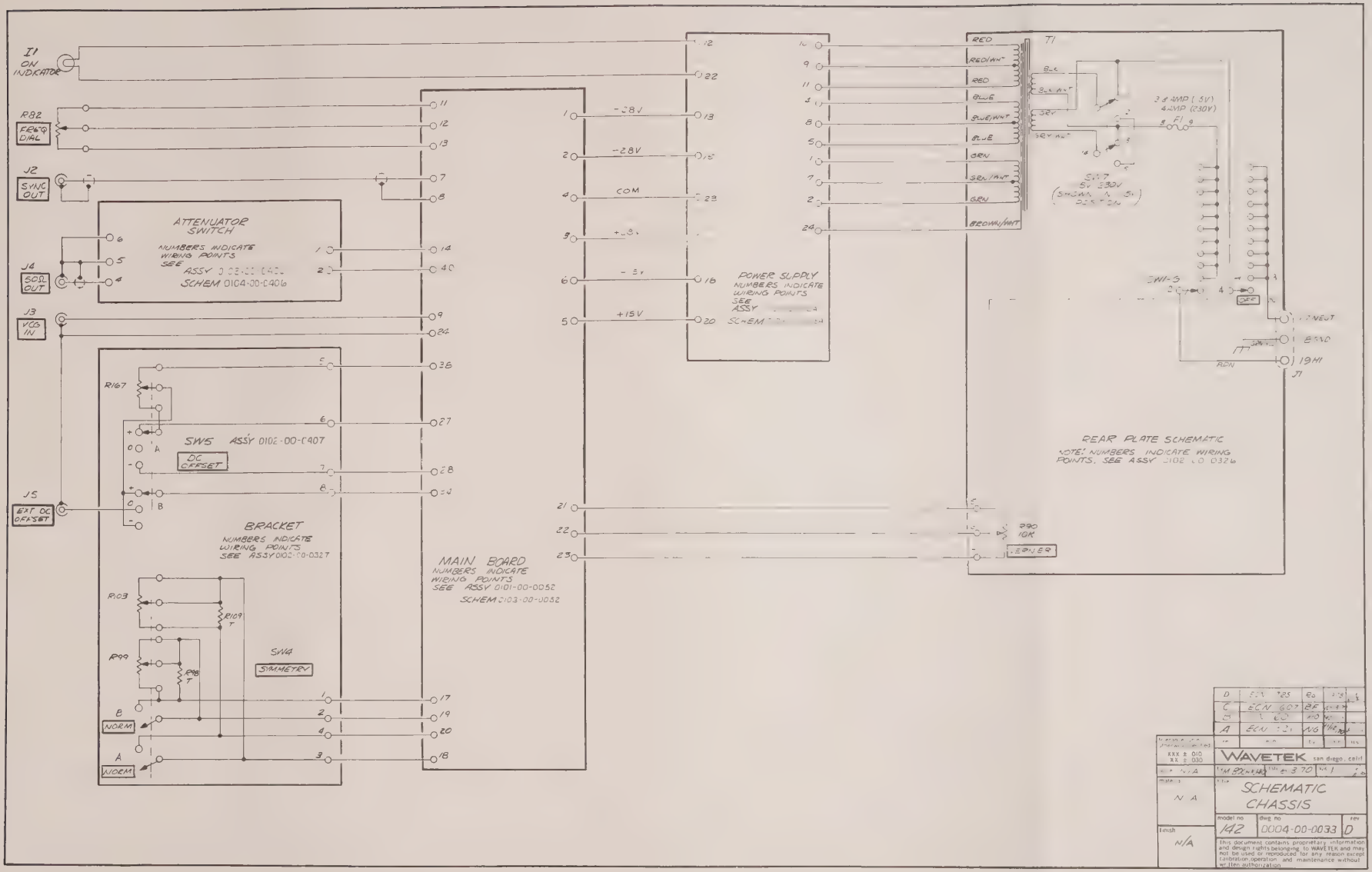

D	ECN 825	EG	3-8	
C	ECN 607	BF	11-4-7	
B	ECN 60	RD	10-1	
A	ECN 121	NG	1-12-74	

WAVETEK san diego, calif

XXX ± .010
XX ± .030
N/A
1/M PX(+1/2)
1/16 ± 3.70
N/A

material: N A

finish: N/A

title: SCHEMATIC CHASSIS

model no: 142

dwg no: 0004-00-0033

rev: D

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REFERENCE DESIGNATORS	PART DESCRIPTION	UNIQ-MFGR-PART-NO	MFGR	WAVETEK NO.	QTY/APP
NONE	ASSY DWG,CHASSIS	01UE-DU-02942	AVIK	0102400-02942	1
13	DIAL ASSY	130-333-0	AVIK	1201-00-0016	1
17	LEVER ASSY	130-393-1	AVIK	1201-10-0017	1
11	NAIL,DRIVE	130-309	AVIK	1400-00-1073	4
7	CASTING,FRONT FRM:11400-00-1081	130-313-1	AVIK	1400-00-1074	1
8	CASTING,REAR FRM:11400-00-1081	13E-3000A	AVIK	1400-00-1749	1
10	INDICATOR,DIAL	141-317	AVIK	1400-00-2020	1
10	PANEL,REAR	14E-307	AVIK	1401-00-2000	1
9	PANEL,FF	1400-00-8700	AVIK	1400-00-8700	1
NONE	LABEL,I.D.	1400-00-8470	AVIK	1400-01-8470	1
J2 J3 J4 J5	BNC CONN	4C-794A8	AMPH	2100-01-0002	4
2E	BOLDER LUG	1447	SMITH	2100-00-0016	3
16	STU KNOB	MS-87-1-54-M	NOLAN	2400-01-0000	2
19	CLAM KNOB DLF	MS-87-1-54-NM-N	NOLAN	2400-01-0001	2
25	BUSHING NYLINER	NL2FF	THOMA	2600-01-0002	3
22	SPEEDNUT,TYPE"U"	C0U41-032-M	TINN	2800-00-0004	4
21	KNOB BUTTON	PC47C91	CINCH	2820-00-0010	2

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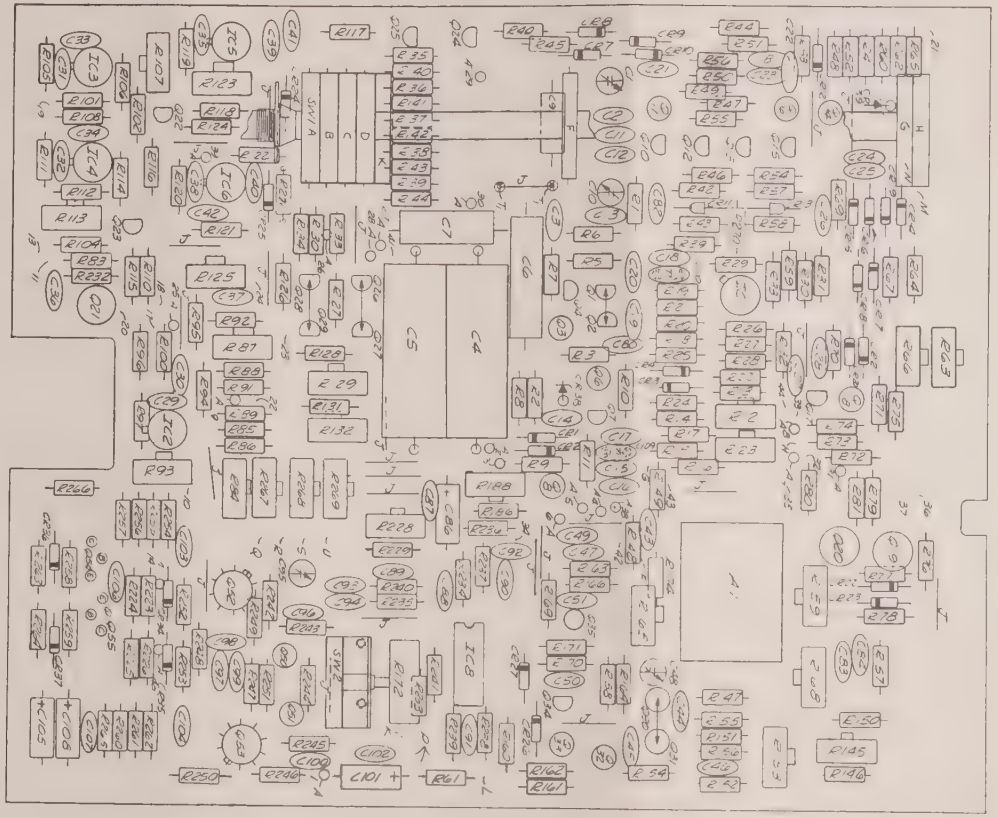
35	PART,CHASSIS	1541-011	USECO	2000-00-0021	8
NONE	HEATSINK ASSY	1163A	INTEM	2800-11-0000	2
21	CAPTIVE SCREW	C4137E-10-3-N	INTIM	2800-03-0001	4
23	WASHER,SHOULDER	2000	SMITH	2800-00-0002	4
3C	NYLON FLAT WASHER	2C0W-N-385	ANSOW	2800-00-0003	4
28	RETAINING RING	5509-31	WARE	2800-00-0010	1

WAVETEK PARTS LIST | TITLE: SIL CHASSIS | ASSEMBLY NO: 1101-00-0033 | PAGE: 2 | REV: F

NOTE UNLESS OTHERWISE SPECIFIED

REMOVE ALL BURRS AND BREAK SHARP EDGES	DRAWN	WAVETEK
MATERIAL		PARTS LIST
FINISH: WAVETEK PROCESS	TOLERANCE UNLESS OTHERWISE SPECIFIED .XXX ± .010 ANGLES ± .XX ± .030	CHASSIS
	DO NOT SCALE DWG	MODEL NO: 142 / DWG NO: 1101-00-0033 / REV: F
		CODE IDENT: 23338 / SHEET OF



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tolerance unless otherwise specified
XXX ± 010
XX ± 030

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by GRAY date 10/29/70

title
ASSY
MAIN BOARD

model no 142

dwg no 0101-00-0052

rev U

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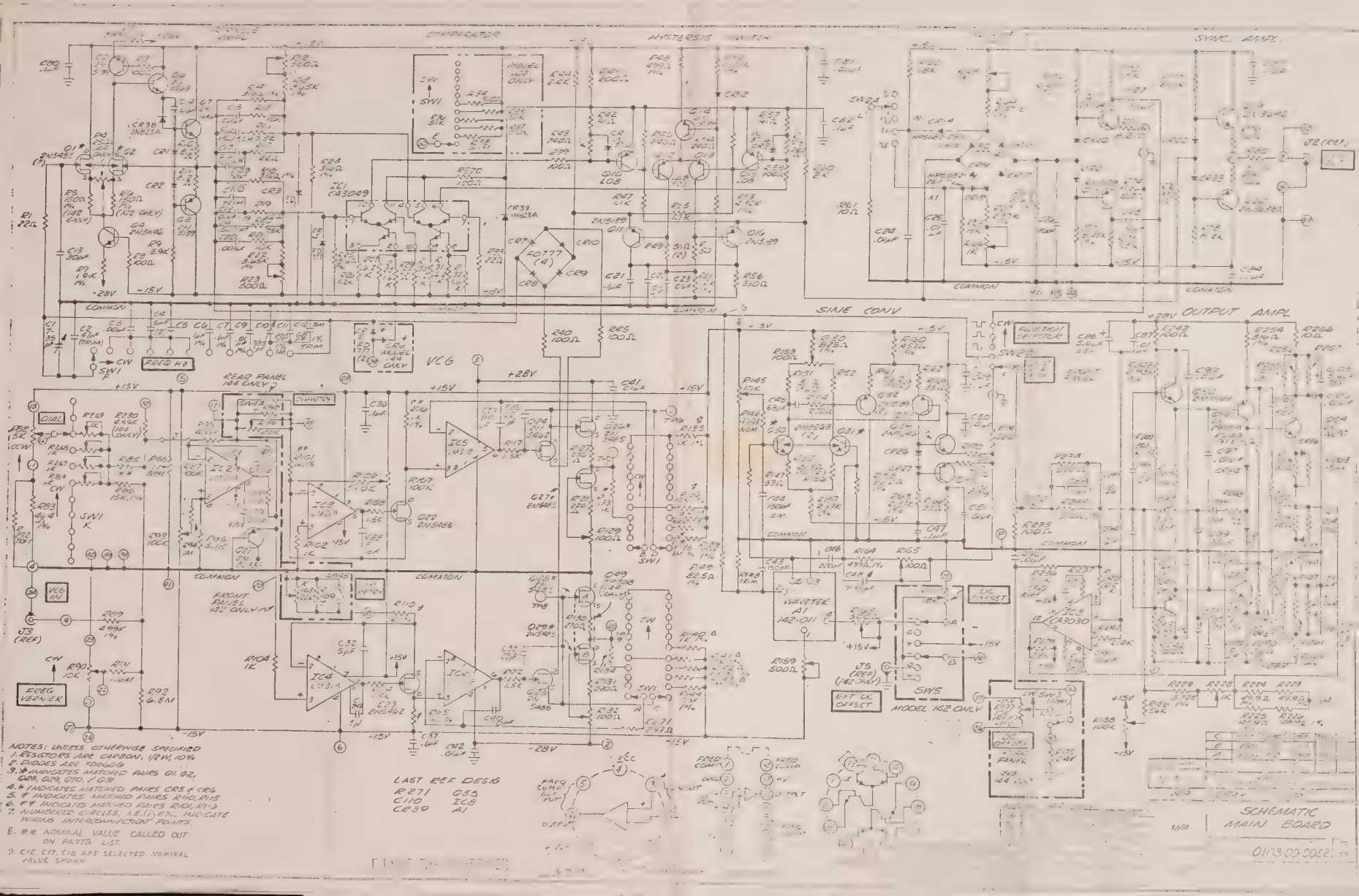
SYNC. AMPL.
SINE CONV
+28V OUTPUT AMPL
VCG
REAR PANEL 142 ONLY
FRONT PANEL 142 ONLY
MODEL 142 ONLY
LAST REF DESIG
R271 Q58
C110 IC8
CR39 A1
NOTES: UNLESS OTHERWISE SPECIFIED
1. RESISTORS ARE CARBON, 1/2W, 10%
2. DIODES ARE 1N914
3. * INDICATES MATCHED PAIRS Q1, Q2, Q28, Q29, Q30, & Q31
4. # INDICATES MATCHED PAIRS CR5 & CR6
5. ^ INDICATES MATCHED PAIRS R10, R13
6. ## INDICATES MATCHED PAIRS R101, R113
7. NUMBERED CIRCLES, I.E.(1) ETC, INDICATE WIRING INTERCONNECTION POINTS.
8. ** NOMINAL VALUE CALLED OUT ON PARTS LIST.
9. C12, C17, C18 ARE SELECTED. NOMINAL VALUE SHOWN
SCHEMATIC
MAIN BOARD
0113-00-0052

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NONE	ASSY DRWG,MAIN	0101-00-0052	WVTK	0101-00-0052	1
NONE	SCHEMATIC,MAIN	142-210	WVTK	0103-00-0052	1
A1	SINE MOD	142-011	WVTK	1200-00-0002	1
SW1	RANGE SW ASSY	142-007	WVTK	1202-00-0010	1
SW2	FUNC SW ASSY	142-008	WVTK	1202-00-0011	1
C99	CAP,CER,5PF,1KV	00-050	CRL	1500-00-5011	1
C26 C86 C90 C91	CAP,CER,100PF,1KV	00-100	CRL	1500-01-0011	4
C03 C15 C20	CAP,CER,..001PF,1KV	00-102	AMCO	1500-01-0211	3
C01= C022 C023 C024 C025 C027 C028 C141 C042 C050 C051 C196 C087 C092 C093 C094 C096 C097 C100 C102 C106 C107	CAP,CER,..01PF,50V	C4-103	CRL	1500-01-0310	22
C103 C104	CAP,CER,..1MF,50V	CK-104	CRL	1500-01-0410	2
C21 C36 C37 C87 C49 C80 C82 C85 C84	CAP,CER,..1MF,20V	UK20-104	CRL	1500-01-0413	9
C89	CAP,CER,15PF,1KV	00-150	AMCO	1500-01-5011	1
C45	CAP,CER,150PF,1KV	00-151	AMCO	1500-01-5111	1
C30 C33 C34 C39 C40 C46	CAP,CER,220PF,1KV	00-221	AMCO	1500-02-2111	6
WAVETEK PARTS LIST	TITLE MAIN	ASSEMBLY NO 1100-00-0052 PAGE: 1		REV Y	

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NONE	TERM	230081	USECO	2100-05-0009	8
NONE	PIN,MALE	# 182-2	AMP	2100-05-0020	14
NONE	LAMP	CM7-7876	CMWN	2800-02-0013	1
NONE	HEAT SINK	NF-207	WAKE	2800-11-0001	2
NONE	TRANSIPAD	13123A	WSTRS	2800-11-0003	5
NONE	TO4&5IPAD	13160	WSTRS	2800-11-0004	2
NONE	HEATSINK NUT	1038	TWEAV	2800-11-0005	2
R129 R132 R153 R165	POT,TRIM,100	91A6100	BECK	4600-01-0103	4
R063 R066 R084 R225 R267 R268 R269	POT,TRIM,1K	3 91A1K	BECK	4600-01-0209	7
R145	POT,TRIM,10K	3 91A10K	BECK	4600-01-0315	1
R087 R095 R107 R113 R123 R125 R188	POT,TRIM,100K	91A9100K	BECK	4600-01-0402	7
R012 R023 R159 R168	POT,TRIM,500	3 64500	BECK	4600-05-0104	4
R265 R266	RES.C.1/2W,5%,10	RC20GF-100	STKPL	4700-25-0100	2
R10 R11 R73 R76	RES.C.1/2W,5%,8.2	RC20GF-8R2	STKPL	4700-25-0820	4
R81	RES.C.1/2W,5%,1.0M	RC20GF-1R05	STKPL	4700-25-1509	1
R59	RES.C.1/2W,5%,3.9M	RC20GF-395	STKPL	4700-25-1904	1
WAVETEK PARTS LIST	TITLE MAIN	ASSEMBLY NO 1100-00-0052 PAGE: 3		REV Y	

REFERENCE DESIGNATORS	PART DESCRIPTION	ORIG-MFGR-PART-NO	MFGR	WAVETEK NO.	QTY/PT
R62 R65	RES,MF,1/8W,1%,18.2K	RN55D-1822F	WVTK	4701-03-1822	2
R001 R017 R019 R029 R033 R155 R158 R174	RES,MF,1/8W,1%,21.5K	RN55D-2152F	WVTK	4701-03-2159	8
R126 R131	RES,MF,1/8W,1%,221	RN55D-2210F	WVTK	4701-03-2211	2
R240 R241	RES,MF,1/8W,1%,2.21K	RN55D-2211F	WVTK	4701-03-2211	2
R044 R052 R062 R066 R067 R157 R 03 R251	RES,MF,1/8W,1%,2.37K	RN55D-2371F	WVTK	4701-03-2371	8
R041 R048 R154 R159 R271	RES,MF,1/8W,1%,249	RN55D-2490F	WVTK	4701-03-2490	5
R127 R130 R142	RES,MF,1/8W,1%,27K	RN55C-2702F	WVTK	4701-03-2702	3
R244	RES,MF,1/8W,1%,2.7K	RN55C-2701F	WVTK	4701-03-1012	1
R018 R018 R024 R025 R069 R078 R235 R240 R256	RES,MF,1/8W,1%,316	RN55D-3160F	WVTK	4701-03-3160	9
R224 W239	RES,MF,1/8W,1%,3.32K	RN55C-3321F	WVTK	4701-03-3321	2
R147 R166 W 69	RES,MF,1/8W,1%,33.2K	RN55D-3322F	WVTK	4701-03-3322	3
R13 W22	RES,MF,1/8W,1%,3.65K	RN55D-3651F	WVTK	4701-03-3651	2
W2	RES,MF,1/8W,1%,3.83K	RN55D-3831F	WVTK	4701-03-3831	1
W9	RES,MF,1/8W,1%,3.92K	RN55C-3921F	WVTK	4701-03-3921	1
W83	RES,MF,1/8W,1%,39.2	RN55D-3922F	WVTK	4701-03-3920	1
WAVETEK PARTS LIST	TITLE MAIN	ASSEMBLY NO 1100-00-0052 PAGE: 4		REV Y	

REFERENCE DESIGNATORS	PART DESCRIPTION	ORIG-MFGR-PART-NO	MFGR	WAVETEK NO.	QTY/PT
C99	CAP,CER,33PF,1KV	00-330	AMCO	1500-03-3011	1
C29 C31 C12 C35 C38	CAP,CER,..005MF,50V	CK-502	CRL	1500-05-0210	5
C45	CAP,CER,68PF,1KV	DC-680	CRL	1500-06-8001	1
C16 C19 C44	CAP,MICA,150PF,500V	DM15-151J	AMCO	1500-11-5100	3
C13	CAP,MICA,30PF,500V	DM15-300J	AMCO	1500-13-0000	1
C21	CAP,MICA,430PF,500V	DM15-431J	AMCO	1500-14-1000	1
C121	CAP,MICA,68PF,500V	DM15-680F	AMCO	1500-18-8001	1
C17 C18	CAP,MICA,820PF,500V	DM15-821J	AMCO	1500-18-2000	2
C11	CAP,MICA,820PF,500V	DM15-821F	AMCO	1500-18-2101	1
C9	CAP,POLYC,.01MF,100V	P82B103F	ELCUA	1500-41-0300	1
C7	CAP,POLYC,.1MF,100V	P82B106F	ELCUA	1500-41-0400	1
C6	CAP,POLYC,1MF,100V	210-81C-105F	IMB	1500-41-0500	1
C4 C5	CAP,POLYC,5MF,100V	C1A505F	ELPAC	1500-45-0500	2
C95	VARI,3.5-15PF,250V	73-TRIMO-02 3.5/13PF	TRIMO	1500-51-3000	1
C01 C10 C48	VARI,7-35PF,250V	73-TRIMO-02 7/35 PF	TRIMO	1500-53-5000	3
C101 C105 C108 C86	CAP,TANT,5.6MF,35V	150D565X9035B2	SPRAG	1500-75-6502	4
NONE	MAIN	142-110	WVTK	1700-00-0052	1
WAVETEK PARTS LIST	TITLE MAIN	ASSEMBLY NO 1100-00-0052 PAGE: 2		REV Y	

REFERENCE DESIGNATORS	PART DESCRIPTION	ORIG-MFGR-PART-NO	MFGR	WAVETEK NO.	QTY/PT
R92	RES.C.1/2W,10%,6.8M	RC20GF-685	STKPL	4700-25-6804	1
R003 R008 R037 R040 R045 R059 R211 R242 R246 R268 R273	RES,MF,1/8W,1%,100	RN55D-1000F	WVTK	4701-03-1000	11
R102 W104 R131 R134	RES,MF,1/8W,1%,	RN55C-1001F	WVTK	4701-03-1001	4
R015 R021 R267	RES,MF,1/8W,1%,10K	RN55C-1002F	WVTK	4701-03-1002	3
R124 R126	RES,MF,1/8W,1%,100K	RN55D-1003F	WVTK	4701-03-1003	2
R061 W079 R091 R170 R171 R253 R258 R259	RES,MF,1/8W,1%,10	RN55D-10R0F	WVTK	4701-03-1000	9
R27 R55	RES,MF,1/8W,1%,1.1K	RN55D-1101F	WVTK	4701-03-1101	2
R26 R30 R51	RES,MF,1/8W,1%,1.21K	RN55D-1211F	WVTK	4701-03-1211	3
R051	RES,MF,1/8W,1%,130K	RN55D-1303F	WVTK	4701-03-1303	1
W258 R5 R6	RES,MF,1/8W,1%,150	RN55D-1500F	WVTK	4701-03-1500	5
W105 R108 R111 R114 R117 W119 R120 W122 W72 W75 R97	RES,MF,1/8W,1%,1.5K	RN55D-1501F	WVTK	4701-03-1501	11
R86	RES,MF,1/8W,1%,15K	RN55D-1502F	WVTK	4701-03-1502	1
R252 R263 R264	RES,MF,1/8W,1%,15	RN55D-15R0F	WVTK	4701-03-15R0	3
R28 R32	RES,MF,1/8W, 1.62K	RN55D-1621F	WVTK	4701-03-1621	2
R1+81	RES,MF,1/8W,1%,1.8K	RN55D-1801F	WVTK	4701-03-1801	1
WAVETEK PARTS LIST	TITLE MAIN	ASSEMBLY NO 1100-00-0052 PAGE: 8		REV Y	

REFERENCE DESIGNATORS	PART DESCRIPTION	ORIG-MFGR-PART-NO	MFGR	WAVETEK NO.	QTY/PT
R53	RES,MF,1/8W,1%,4.32K	RN55D-4321F	WVTK	4701-03-4321	3
W180	RES,MF, 1.24K	RN55D-4421F	WVTK	4701-03-4421	1
R83	RES,MF, 4K, 1.2K	RN55D-4492F	WVTK	4701-03-4492	1
R184 R237 R28	RES,MF,1/8,1%,499	RN55D-4990F	WVTK	4701-03-4990	3
R089 R095 R096 R216	RES,MF, 1.3K, 1	RN55D-4991F	WVTK	4701-03-4991	4
R140T	RES,MF,1/8W,1%,49.9K	RN55D-4992F	WVTK	4701-03-4992	1
R040 R050 R151 R152	RES,MF,1/8W,1%,511	RN55D-5110F	WVTK	4701-03-5110	4
R180	RES,MF,1/8W,1%,56.2K	RN55D-5622F	WVTK	4701-03-5622	1
R158 W181 R182	RES,MF,1/8W,1%,56.2	RN55D-56R2F	WVTK	4701-03-56R2	3
R230	RES,MF,1/8W,1%,576	RN55D-5760F	WVTK	4701-03-5760	1
R27 R31	RES,MF,1/8W,1%,6.19K	RN55D-6191F	WVTK	4701-03-6191	2
R245 W245	RES,MF,1/8W,1%,6.49K	RN55C-6491F	WVTK	4701-03-6981	2
W100	RES,MF,1/8W,1%,750	RN55D-7500F	WVTK	4701-03-7500	1
R16 R20	RES,MF, 1.7K	RN55D-7501F	WVTK	4701-03-7501	2
R150	RES,MF,1/8W,1%,825	RN55D-8250F	WVTK	4701-03-8250	1
R70 R71 R77 R78	RES,MF,1/8W,1%,8.25K	RN55D-8251F	WVTK	4701-03-8251	4
R149	RES,MF,1/8W,1%,82.5	RN55D-82R5F	WVTK	4701-03-8250	1
WAVETEK PARTS LIST	TITLE MAIN	ASSEMBLY NO 1100-00-0052 PAGE: 6		REV Y	

NOTE UNLESS OTHERWISE SPECIFIED

REMOVE ALL BURRS AND SHARP EDGES

MATERIAL

FINISH WAVETEK PROCESS

DRAWN

DATE

PROJ ENGR

RELEASE APPROV

TOLERANCE UNLESS OTHERWISE SPECIFIED .XXX ±.010 ANGLES ±1 .XX ±.030

DO NOT SCALE DWG

SCALE

WAVETEK

TITLE
PARTS LIST
MAIN BOARD

MODEL NO 142

DRAWING NO 1100-00-0052

REV Y

SIZE D

CAGE CODE 23339

SHEET 7 OF 2

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REV		BY	DATE	APP

REFERENCE DESIGNATORS	PART DESCRIPTION	ORIG-MFGR-PART-NO	MFGR	WAVETEK NO.	QTY/PT
Q17 Q54 Q6 Q7	TRANS	2N3646	NSC	4901-03-6060	4
Q56	TRANS	2N0047	FAIR	4901-04-0470	1
Q11 Q14 Q16 Q18 Q3 Q32 Q33 Q35 Q8	TRANS	2N5139	FAIR	4901-05-1390	9
Q55	TRANS	2N5160	MOT	4901-05-1600	1
Q22 Q25	TRANS	2N5086	MOT	4901-05-0860	2
Q10 Q12 Q13 Q15	TRANS	MPS-L08	FAIR	4902-00-0080	4
Q53	TRANS,SEL.2N22194 QTY1:14901-02-2191	142-501-00	AVTK	4998-00-0001	1
Q30 Q31	TRANS,M/PR,2N3583 QTY1:24901-03-5830	142-501-52	AVTK	4998-00-0004	1
Q73 Q24	TRANS,SEL,2N5467 QTY1:14901-05-4620	142-501-55	AVTK	4998-00-0008	2
Q1 Q2 Q26 Q27 Q28 Q29	TRANS,M/PR,2N5086 QTY1:24901-05-0850	142-501-53	AVTK	4998-00-0009	5
NONE	DETENT HOD FROM:5100-01-0010	5100-00-0003	AVTK	5104-00-0003	1
IC1	IC	CA-3049	RCA	7000-30-4900	
IC8	IC,CLASS I,CA-3030 QTY1:17000-30-3000	130-501-15	AVTK	7200-00-0001	1
IC2 IC3 IC4 IC5 IC6	IC,CLASS I,MA-709	130-501-13	AVTK	7200-00-0005	5

WAVETEK PARTS LIST — TITLE: MAIN — ASSEMBLY NO 1100-00-0052 — REV Y — PAGE: 9

REFERENCE DESIGNATORS	PART DESCRIPTION	ORIG-MFGR-PART-NO	MFGR	WAVETEK NO.	QTY/PT
R42 R57	RES,MF,1/8W,1%,90.9	RN55D-9090F	TRW	4701-03-9090	2
R60	RES,MF,1/8W,1%,1M	RN60D-1004F	TRW	4701-13-1004	1
R107 R249	RES,MF,1/8W,1%,1.91K	RN60D-1911F	TRW	4701-13-1911	2
R41	RES,MF,1/8W,1%,196	RN60D-1960F	TRW	4701-13-1966	1
R56	RES,MF,1/8W,1%,11Ω	RN60D-11R0F	TRW	4701-13-11R0	1
R106 R112 R118 R121	RES,MF,1/8W,1%,499K	RN60D-4993F	TRW	4701-13-4993	4
R223 R224 R225 R226 R255 R256 R257 R260 R261 R262	RES,MF,1/8W,1%,49.9	RN60D-49R9F	TRW	4701-13-49R9	10
R101 R110 R115 R116	RES,SET,2-1K,1/8W QTY1:24701-01-1001	142-501-09	AVTK	4789-00-0006	2
R135 R140	RES,MF,MIXED SET	142-501-50	AVTK	4789-00-0033	1
	RES,MF,1/8W,1% PART OF 4789-00-0033 QTY(2)				
R136 R141	RES,MF,1/8W,1% PART OF 4789-00-0033 QTY(2)				
R137 R142	RES,MF,1/8W,1%,100K PART OF 4789-00-0033 QTY(2)				

WAVETEK PARTS LIST — TITLE: MAIN — ASSEMBLY NO 1100-00-0052 — REV Y — PAGE: 7

REFERENCE DESIGNATORS	PART DESCRIPTION	ORIG-MFGR-PART-NO	MFGR	WAVETEK NO.	QTY/PT
	QTY1:17000-07-0900				

REFERENCE DESIGNATORS	PART DESCRIPTION	ORIG-MFGR-PART-NO	MFGR	WAVETEK NO.	QTY/PT
	RES,MF,MIXED SET			4789-00-0033	
R138 R143	RES,MF,1/8W,1%,1M PART OF 4789-00-0033 QTY(2)				
R139 R140	RES,MF,1/8W,1%,10M	MK-181	CADDO	4789-00-0003	2
CR30	DIODE,ZENER 6.2V	1N823A	NPC	4901-01-6825	2
CR15	DIODE	1N3716	GI	4902-01-3716	2
CR16 CR17 CR18	DIODE	FD-777	FAIR	4902-02-0777	4
CR02 CR03 CR04 CR20 CR21 CR22 CR24 CR25 CR26 CR34 CR35 CR36	DIODE	FD-6000	FAIR	4902-02-6000	17
CR19	DIODE	5082-2811			
CR7 CR8 CR9	QTY10:0807-02-0777	142-501-57			
Q50 Q6	TRANS	2N2905A	NSC	4901-02-9051	1
Q20 Q21	TRANS	2N3563	FAIR	4901-03-5610	2
Q51	TRANS	2N3638A	CRTH	4901-03-6381	2
Q19	TRANS	2N3640	FAIR	4901-03-6400	1
	TRANS	2N3642	FAIR	4901-03-6420	1

WAVETEK PARTS LIST — TITLE: MAIN — ASSEMBLY NO 1100-00-0052 — REV Y — PAGE: 8

REMOVE ALL BURRS AND BREAK SHARP EDGES	DRAWN	DATE
MATERIAL		
FINISH MATTE PROCESS	TOLERANCE UNLESS OTHERWISE SPECIFIED FRAC DEC ANGLES .X .XX .XXX	
	DO NOT SCALE DRAWING	
	SCALE	

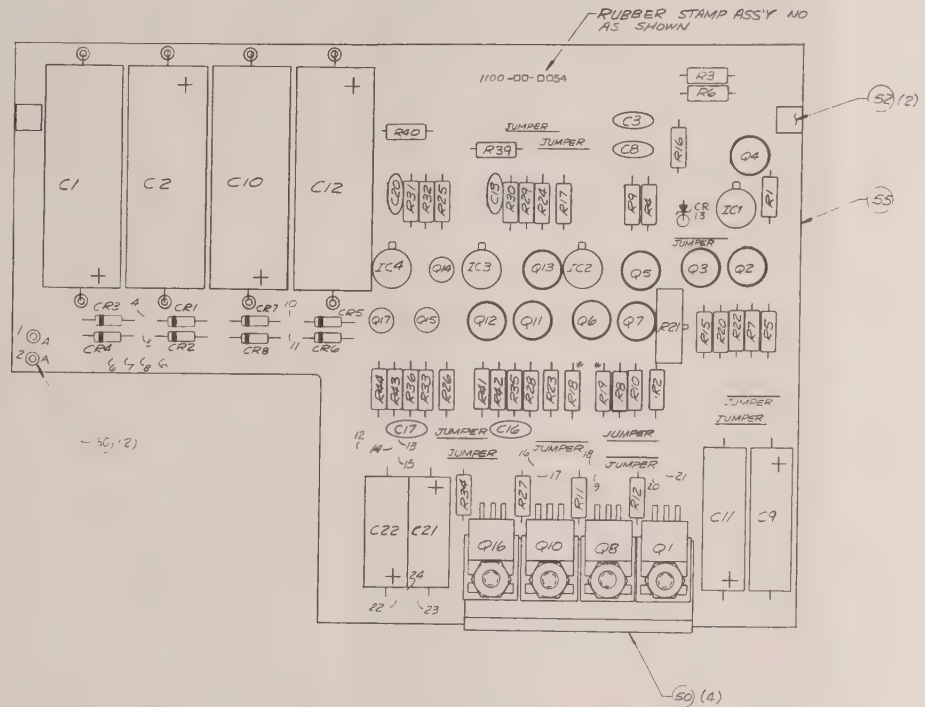
WAVETEK SAN DIEGO, CALIFORNIA

TITLE: PARTS LIST MAIN BOARD

MODEL NO. 42 — DWG NO. 1100-00-0052 — REV Y

USE 23338 — SHEET 2 OF 2

NOTE UNLESS OTHERWISE SPECIFIED



WIRE LIST (REF: 0004-02-0035)				
FROM	TO	COLOR	GAUGE	LEN
T1	PS-1	GRN		
PS-1	ST-21	GRN	2	
T1	PS-2	GRN		
PS-2	ST-22	GRN		
T1	PS-4	BLK		
T1	PS-5	BLK		
ST-20	ST-20	GRN/WHT		25
"	PS-7	GRN/WHT		
"	PS-8	BLK		
"	PS-9	RED/WHT		
T1	PS-10	RED		
T	PS-11	RED		
PS-6	[illegible]	WHT	26	
J5-4	Y18	[illegible]		
J1-4	ST-21	[illegible]	22	
[illegible]	Y18-2	[illegible]		
J5-3	Y18-3	BLK		
J1-3	[illegible]	BLK	22	
PS-8	A18-2	RED		
[illegible]	[illegible]	RED		
P1-20	MB-5	RED		
PS-21	ST-7	GRN		
T1	P1-22	SPKR WHT		
[illegible]	MB-2 (SPKR)	BLK		
P1-23	P1-[illegible]	[illegible]		

LEGEND:
J5 = [illegible]
S[illegible] = [illegible]
[illegible] = [illegible]
PS = FRONT PANEL
T = TRANSFORMER

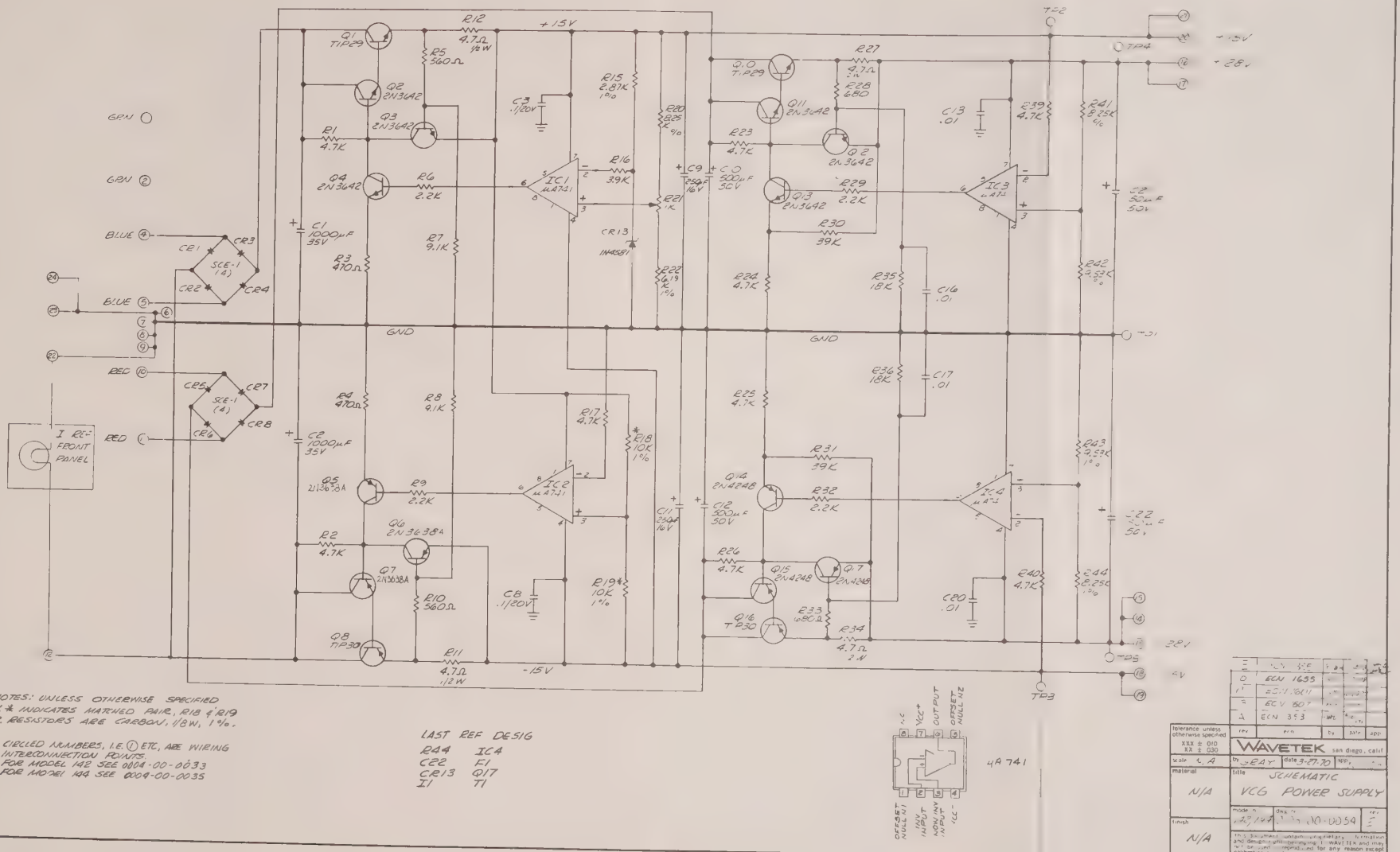
NOTE:
1) * INDICATES MATCHED PAIR

NO	ECN NO	INIT	DATE
[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	ECN 1601	[illegible]	[illegible]
K	ECN 1627	[illegible]	[illegible]
J	ECN 882	[illegible]	[illegible]
H	ECN 428	[illegible]	[illegible]
G	ECN 429	[illegible]	[illegible]
F	39	[illegible]	[illegible]
E	ECN 374	[illegible]	[illegible]
D	ECN 353	[illegible]	[illegible]
C	ECN 327	[illegible]	[illegible]

tolerance unless otherwise specified
XXX ± .010
XX ± .030
SURFACE
material
1 of A
finish
1 of A

WAVETEK
[illegible]
POWER SUPPLY
model no 1421,42A
dwg no 0101-00-0054
rev N

[illegible] rights belonging to WAVETEK and may not be [illegible] or reproduced [illegible] without [illegible]



NOTES: UNLESS OTHERWISE SPECIFIED
1. * INDICATES MATCHED PAIR, R18 & R19
2. RESISTORS ARE CARBON, 1/8W, 1%.

4. CIRCLED NUMBERS, I.E. ① ETC, ARE WIRING INTERCONNECTION POINTS.
FOR MODEL 142 SEE 0004-00-0033
FOR MODEL 144 SEE 0004-00-0035

LAST REF DESIG

R44	IC4
C22	F1
CR13	Q17
J1	T1

rev	description	by	date	app.
D	ECN 1635			
C	ECN 1611			
B	ECN 607			
A	ECN 353			

tolerance unless otherwise specified: XXX ± .010, XX ± .030

WAVETEK, san diego, calif

scale: 1:1 A | by: RAT | date: 3-27-70

material: N/A

title: SCHEMATIC
VCG POWER SUPPLY

model no.: 23144 | dwg. no.: 0004-00-0054 | rev.: E

finish: N/A

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REV	P.N.	BY	DATE	APP

REFERENCE DESIGNATORS	PART DESCRIPTION	OMIG-MFGR-PART-NO	MFGR	WAVETEK NO.	ATT/PT
NONE	ASSY DRWG,POWER	0101-00-0054	WVTK	0101-00-0054	.
NONE	SCHEMATIC, POWER	0103-00-0054	WVTK	0103-00-0054	1
S4	HEATSINK	142-303	WVTK	400-05-2001	1
50	INSULATOR,MICA	142-311	WVTK	1400-00-2080	~
C13 C16 C17 C20	CAP,CER,.01MF,50V	CK-103	CRL	1500-01-0310	~
C3 C8	CAP,CER,.1MF,20V	UK20-104	CRL	1500-01-0415	~
C1 C2	CAP,ELECT,1000MF,35V	39D108G035GL6	SPRAG	1500-31-0212	~
C11 C9	CAP,ELECT,250MF,16V	500D257G016DF7	SPRAG	1500-32-5101	~
C21 C22	CAP,ELECT,50MF,50V	500D506G050DG7	SPRAG	1500-35-0003	~
C10 C12	CAP,ELECT,500MF,50V	39D507G050GL6	SPRAG	1500-35-0103	~
S5	POWER	148-111	WVTK	1700-00-0056	~
60	TERM	2010P1	SPC	2100-05-0011	~
52	PART,CHASSIS	1591-611	SPEC	2800-09-0041	~
W21	PUT,T+J+W,1A	91A1A	MACH	4800-01-0209	.
W11 W12 W27 W36	RES,C,1/2W,5%,0.7	RC20GF-0R7	STACK	4700-25-0476	~
W35 W36	RES,MF,1/8W,1%,1R.2A	RN55D-1822F	TWA	4701-03-1822	~
R06 R09 W29 W32	RES,MF,1/8W,1%,2.21K	RN55D-2211F	TWA	4701-03-2211	~
R15	RES,MF,1/8W,1%,2.87K	RN55D-2871F	TWA	4701-03-2871	1

WAVETEK PARTS LIST | TITLE: POWER | ASSEMBLY NO: 1100-00-0054 | PAGE: 1 | REV: L

REFERENCE DESIGNATORS	PART DESCRIPTION	OMIG-MFGR-PART-NO	MFGR	WAVETEK NO.	ATT/PT
Q01 Q10	TRANS	TIP-29	TI	4902-00-0290	~
Q08 Q16	TRANS	TIP-30	TI	4902-00-0300	~
IC1 IC2 IC3 IC4	IC	LM741CH	NS	7000-01-0101	~

WAVETEK PARTS LIST | TITLE: POWER | ASSEMBLY NO: 1100-00-0054 | PAGE: 1 | REV: L

REFERENCE DESIGNATORS	PART DESCRIPTION	OMIG-MFGR-PART-NO	MFGR	WAVETEK NO.	ATT/PT
R30 R31	RES,MF,1/8W,1%,38.3K	RN55D-3832F	TWA	4701-03-3832	~
R16	RES,MF,1/8W,1%,3.92K	RN55D-3921F	TWA	4701-03-3921	1
R3 R4	RES,MF,1/8W,1%,60R	RN55D-60R0F	TWA	4701-03-60R0	~
R01 R02 R17 R23 R24 R25 R26 R34 R40	RES,MF,1/8W,1%,4.75K	RN55D-4751F	TWA	4701-03-4751	~
R05 R10	RES,MF,1/8W,1%,57R	RN55D-57R0F	TWA	4701-03-57R0	~
R22	RES,MF,1/8W,1%,6.19K	RN55D-6191F	TWA	4701-03-6191	1
R28 R33	RES,MF,1/8W,1%,6R1	RN55C-6R10F	TWA	4701-01-6R10	~
R20 R21 R44	RES,MF,1/8W,1%,8.25K	RN55D-8251F	TWA	4701-03-8251	~
R7 R8	RES,MF,1/8W,1%,9.09K	RN55D-9091F	TWA	4701-03-9091	~
R42 R43	RES,MF,1/8W,1%,9.53K	RN55F-9531F	TWA	4701-03-9531	~
R18 R19	RES,DET,2-10K,1/8W QT=121=4701-03-1002	142-501-00	WVTK	0789-00-0018	1
CR13	DIODE	1N4581	MICRO	6001-01-4581	~
CR1 CR2 CR3 CR4 CR5 CR6 CR7 CR8	DIODE	SCE-	SEMT	6001-07-0001	~
Q5 Q6 Q7	TRANS	2N5415P1	CENTR	6901-03-0381	~
Q11 Q12 Q13 Q2 Q3 Q4	TRANS	2N3642	FAIR	6901-03-6420	~
Q14 Q15 Q17	TRANS	2N4265	FAIR	6901-04-2655	~

WAVETEK PARTS LIST | TITLE: POWER | ASSEMBLY NO: 1100-00-0054 | PAGE: 2 | REV: L

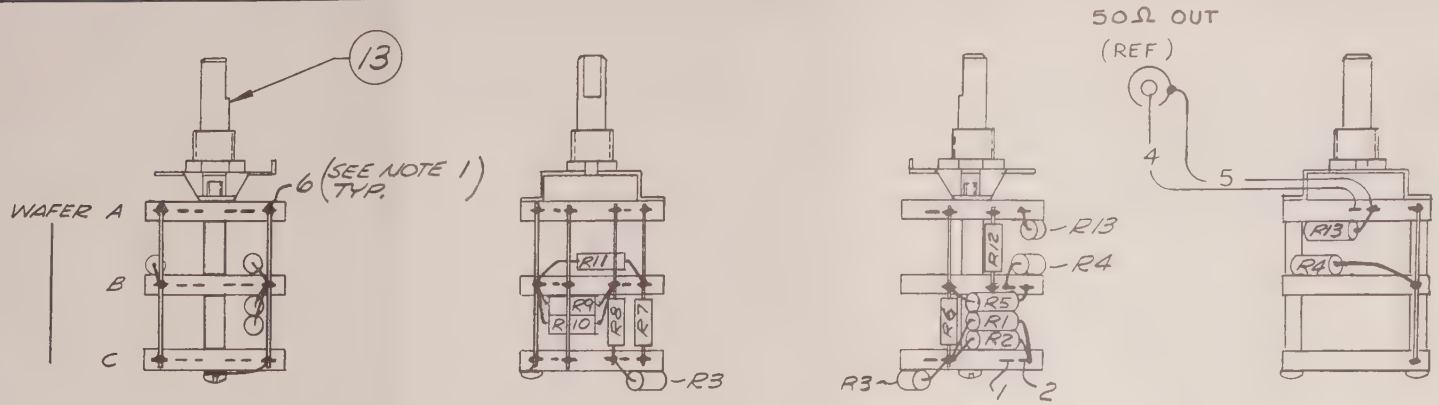
REMOVE ALL BURRS AND SHARP EDGES	DRAWN	DATE
MATERIAL	PROJ ENGR	
	RELEASE APPROV	
FINISH WAVETEK PROCESS	TOLERANCE UNLESS OTHERWISE SPECIFIED XXX = .010 ANGLES = 1 XX = .06	
	DO NOT SCALE DWG.	
	SCALE	

WAVETEK SAN DIEGO, CA

TITLE: PARTS LIST POWER SUPPLY

MODEL NO: 142 | DWG NO: 1101-00-0054 | REV: L | CODE IDENT: 23338 | SHEET 1 OF 1

NOTE UNLESS OTHERWISE SPECIFIED



NOTES: UNLESS OTHERWISE SPECIFIED

1) NUMBERS INDICATE WIRE TERMINATION POINTS.

B	ECN 409	S	11/17/70	S
A	ECN 321	N/G	11/24/70	

TOLERANCE UNLESS OTHERWISE SPEC: XXX ±.10, XX ±.02, ANGLES ±.30

WAVETEK SAN DIEGO CALIF

SCALE N/A | DRN BD. 5-20 | APP'D K.S. 7-20

MATERIAL N/A

TITLE ASSEMBLY, ATTENUATOR SH 2 OF 8

FINISH N/A

DWG NO 142/144-202-00-0008 REV B

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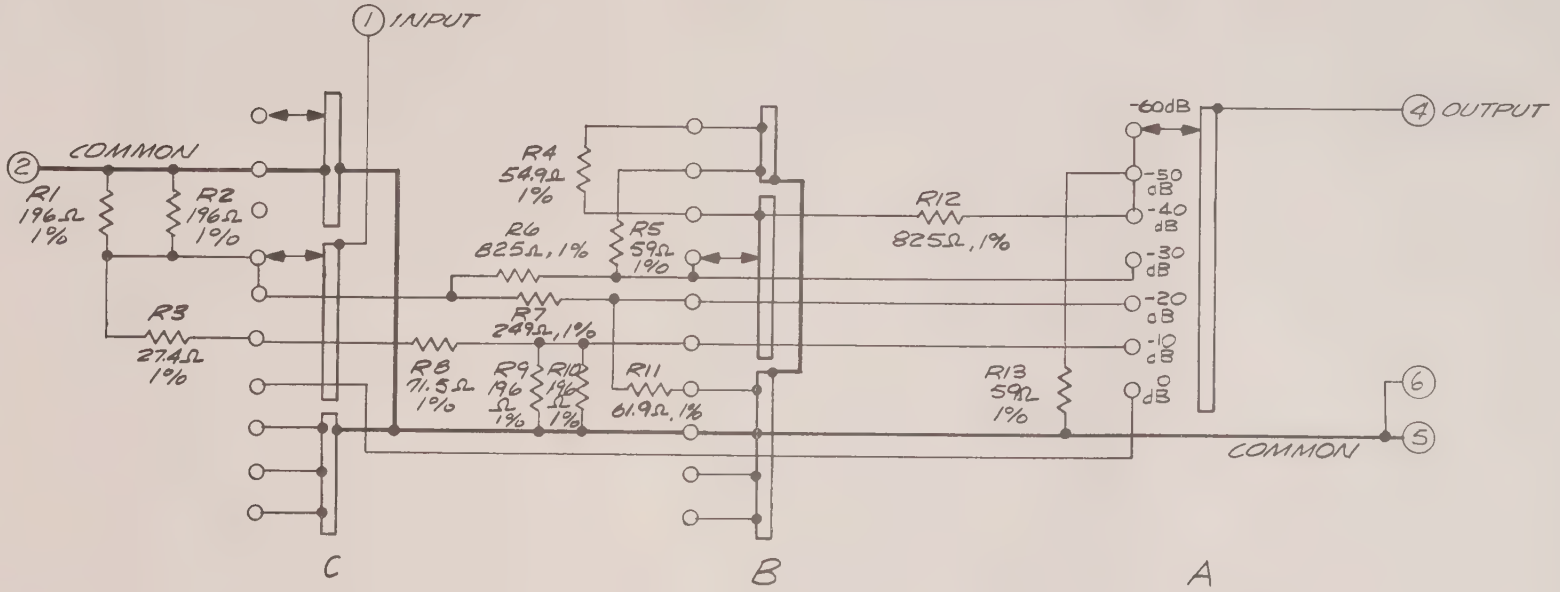

NOTES: UNLESS OTHERWISE SPECIFIED

1. CIRCLED NUMBERS, I.E. (1) ETC, INDICATE WIRING INTERCONNECTIONS.

REV	ECN	BY	DATE	APP
B	UPDATE TO COMPUTER SYS	BJ	10/3/11	
A	ECN 321	WG	11/2/10	KSP

TOLERANCE UNLESS OTHERWISE SPEC: XXX ± .010, XX ± .030, ANGLES ± 0°30

WAVETEK SAN DIEGO, CALIF

SCALE | BY BJ | DATE 5-20 | APP K.S.P.

MATERIAL | FINISH

TITLE: SCHEMATIC, ATTENUATOR

MODEL NO. 1442/1444 | DWG NO. 1202-00-0008 | REV B | SHT 3 OF 3

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REFERENCE DESIGNATORS	PART DESCRIPTION	ORIG-MFGR-PART-NO	MFGR	WAVETEK NO.	QTY/PT
R7	RES,MF,1/8W,1%,249	RN550-2490F	TRW	4701-03-2490	1
R3	RES,MF,1/8W,1%,27.4	RN550-27R4F	TRW	4701-03-27R0	1
R6	RES,MF,1/8W,1%,58.9	RN550-58R9F	TRW	4701-03-5899	1
R05 R13	RES,MF,1/8W,1%,59	RN550-59R0F	TRW	4701-03-5909	2
R11	RES,MF,1/8W,1%,61.9	RN550-61R9F	TRW	4701-03-6190	1
R06 R12	RES,MF,1/8W,1%,825	RN550-8250F	TRW	4701-03-8250	2
D01 R02 R09 R10	RES,MF,1/4W,1%,196	RN60D-1960F	TRW	4701-13-1960	4
R8	RES,MF,1/4W,1%,71.5	RN60D-71R5F	TRW	4701-13-7150	1
S3	SWITCH ASSY ROTARY	136-8-18	AVTK	5104-00-0018	1

WAVETEK PARTS LIST

TITLE
ATTEN 5A ASSY

ASSEMBLY NO
1202-00-0004

REV

PAGE 1

NOTE UNLESS OTHERWISE SPECIFIED

REMOVE ALL BURRS AND SHARP EDGES

MATERIAL

FINISH WAVETEK PROCESS

DRAWN

DATE

PROTRACE

RELEASE APPROVAL

TOLERANCE UNLESS OTHERWISE SPECIFIED
XXX .010
XX .02
ANGLES 1°

CONCENTRIC DWG.

SCALE

WAVETEK

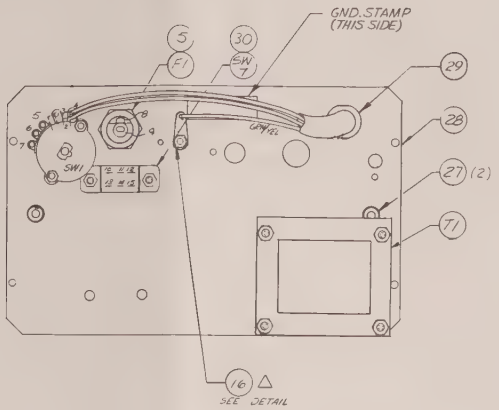
TITLE
ATTEN 5A ASSY

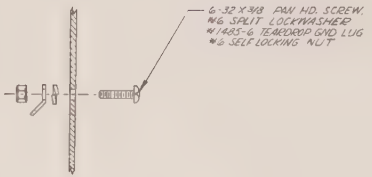
MODEL NO
1202

DWG NO
1202-00-0004

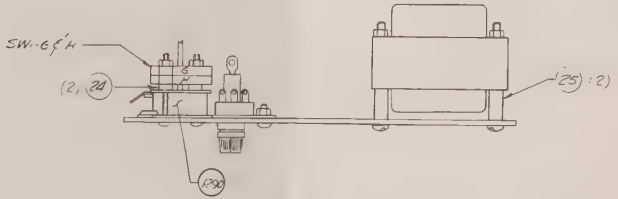
ENG
23318

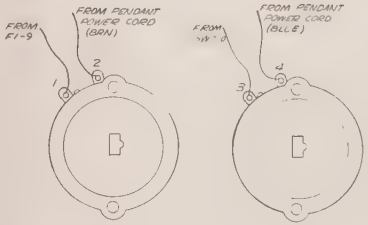
REV





DETAIL
GROUND LUG INSTL.





SW1-G SW1-H

⚠ ALL CONNECTIONS TO BE MECHANICALLY SECURE TO LUGS PRIOR TO SOLDERING GROUND WIRES

NOTES: UNLESS OTHERWISE SPECIFIED

tolerance unless otherwise specified	WAVETEK san diego, calif
XXX ± .010 XX ± .030	
scale FULL	
material N/A	title ASSEMBLY REAR PLATE
finish N/A	model no 142 dwg no 0142-00-0326 rev N

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REV	ECN	BY	DATE	APP

REFERENCE DESIGNATORS	PART DESCRIPTION	CMTG-MFGR-PART-NO.	MFGR	MFGR'S PART #	
T1	TRANSFORMER	142-500	MWTK	1200-03-0005	1
16	SOLDER LUG	1HR5-B	SWITH	2150-04-00045	1
5	FUSE HOLD	031.1251/031.1000	SCHUR	2800-05-0012	1
25	SPACER .562 H, .250 DIA .140 DIA THRU	4713	SWITH	2850-04-0004	4
27	NUT,PRESS	MKKM-10-32-SCR	AUSAN	2800-04-0008	2
BUSH	STRAIN RELIEF BUSH	Strain-1	MISCU	2800-32-0001	1
MOD	POT,CONT,10K FROM:5104-02-0007	130-R1A	MWTK	4800-01-0105	1
SW7	SWITCH ASSY SLIDE	MA256-LP	SWITH	5104-01-0002	1
29	PWR CORD	0-7789-80P-6T	PACRD	6001-40-0004	1

WAVETEK PARTS LIST

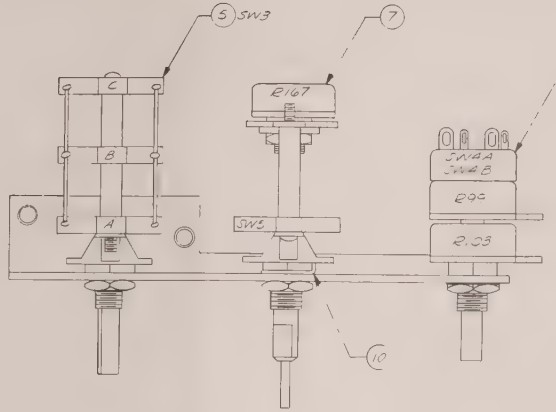
TITLE
REAR PLATE ASSY

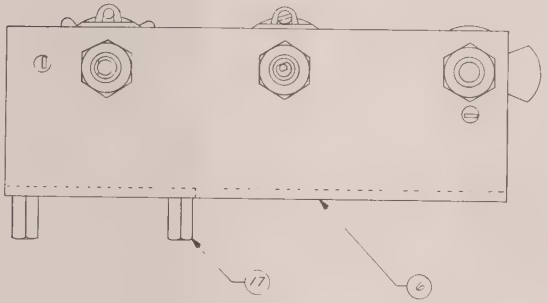
1101-00-0067

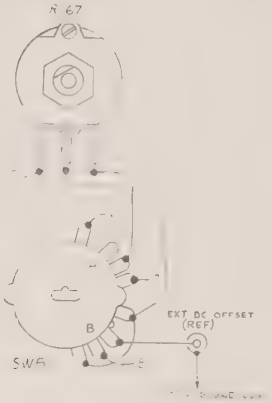
PAGE 1

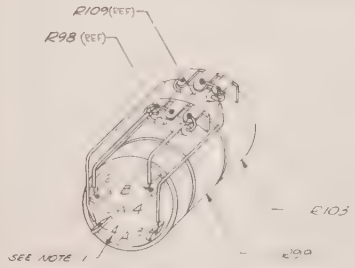
NOTE UNLESS OTHERWISE SPECIFIED

REMOVE ALL BURRS AND SHEAR SHARP EDGES	DRAWN	DATE	WAVETEK SAN DIEGO, CA
MATERIAL	PROJ ENGR		TITLE PARTS LIST REAR PLATE ASSY
FINISH WAVETEK PROCESS	RELEASE APPROV		
	TOLERANCE UNLESS OTHERWISE SPECIFIED .XXX ±.010 .XX ±.030		MODEL NO 142 DWG NO 1101 00 006 REV K
	DO NOT SCALE DWG		CODE IDENT 23338 SHEET 1 OF 1
	SCALE		









DETAIL A
SW4

NOTES: UNLESS OTHERWISE SPECIFIED
1. NUMBERS INDICATE WIRE TERMINATION POINTS, SEE SCHEMATIC 0004-00-0033

	A	ECN 321	WS	9/4/84	
tolerance unless otherwise specified	rev	ecn	by	date	app
XXX ± 010 XX ± 030	WAVETEK				
scale 8/11	by GRAY	Date 8/2 70	SIZE		
material					
finish					

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REV	ECN	BY	DATE	APP

REFERENCE DESIGNATORS	PART DESCRIPTION	ORIG-MFGR-PART-NO	MFGR	WAVETEK NO.	QTY/PT
NONE	ASSY DRWG BRKT	0102-00-0327	WVTK	0102-00-0327	1
5	ATTEN SW ASSY	142-003	WVTK	1202-00-0008	1
7	D/C OFFSET SW ASSY	142-004	WVTK	1202-00-0009	1
6	BRKT	142-304	WVTK	1400-00-2053	1
17	STANDOFF,SPACE .625 H,.250 HEX 6-32,.062 MTG	15318-5/8	USECO	2800-02-0006	2
8	POT,SWITCH MOD FROM:8802-12-0302	4809-80-0006	WVTK	4809-80-0006	1
10	SWITCH STOP	215-33-001-01-22	CTS	5104-07-0003	2

WAVETEK PARTS LIST	TITLE: BRACKET ASSY	ASSEMBLY NO: 1101-00-0068	REV: C
		PAGE: 1	

REMOVE ALL BURRS AND BREAK SHARP EDGES	DRAWN	DATE	WAVETEK SAN DIEGO, CALIFORNIA
MATERIAL	PROJ ENGR		TITLE: PARTS LIST BRACKET ASSY
	RELEASE APPROV		
FINISH WAVETEK PROCESS	TOLERANCE UNLESS OTHERWISE SPECIFIED .XXX ± .010 ANGLES ± 1° .XX ± .030		
	DO NOT SCALE DWG	MODEL NO: 142	DWG NO: 1101-00-0068 REV: C
	SCALE	CODE IDENT: 23338	SHEET 1 OF 1

NOTE: UNLESS OTHERWISE SPECIFIED

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